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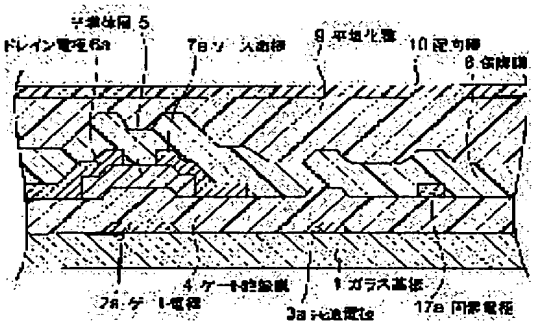
(54) ACTIVE MATRIX SUBSTRATE AND METHOD OF MANUFACTURING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a liquid crystal display device of the IPS method in which the pixel electrode and the counter electrode are formed as a comb-like state so as to obtain a low threshold voltage and a more uniform lateral electric field in such a manner that the comb-like electrodes are interdigitated with each other and that the width of the electrode lines and the distance between the lines are finely formed, and to solve such a problem that the device has some parts where the rubbing treatment is insufficiently done or missed due to the difference in the height between electrodes as a result of finely forming the electrode line width and the distance between the lines.
SOLUTION: A flattening film 9 formed on a protective film 8 consists of an acrylic resin-based photosensitive resin so that the flattening film 9 can be formed without increasing the number of process and that rubbing failure due to recesses and projections of the TFT, drain electrode 6a, common electrode 3a and pixel electrode 17a can be suppressed.



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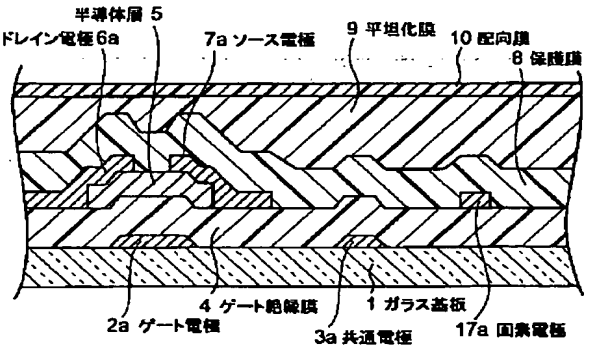
(54)【発明の名称】　アクティブマトリクス基板及びその製造方法

(57)【要約】
【課題】ＩＰＳ方式の液晶表示装置における画素電極と対向電極は、しきい値電圧が低くてより均一な横電界を得るために櫛歯状で、互いに櫛歯が挟み合い、電極配線幅や配線間の距離を緻密に形成される。しかし、電極配線幅や配線間の距離を緻密に形成する結果として、電極間の高さの関係によってラビングが不足あるいはラビングされないような場所が発生してしまう。
【解決手段】保護膜８の上に形成した平坦化膜９をアクリル樹脂をベースとした感光性樹脂より形成することで工程数を増やすことなく平坦化膜９の形成を行うことができ、ＴＦＴおよびドレイン電極６ａ、共通電極３ａ、画素電極１７ａの凹凸に起因したラビング不良を抑制することができる。



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【特許請求の範囲】

【請求項１】　基板の上に設けられたゲート電極を兼ねるゲート配線及び共通電極を兼ねる共通配線と、前記ゲート配線の上方に第１絶縁膜を挟んで設けられた半導体層と、ソース電極、画素電極を兼ね前記半導体層と接続されるソース配線及びドレイン電極を兼ね前記半導体層と接続されるドレイン配線と、前記半導体層、前記ソース配線、前記ドレイン配線を含む前記基板の表面を覆う第２絶縁膜及びその上の第３絶縁膜と、からなり、前記共通電極及び前記ソース配線は、互いに併行するそれぞれ共通電極及び画素電極を有しており、前記共通電極と前記画素電極との間に電圧を印加することにより液晶の向きを制御するアクティブマトリクス基板であって、前記第２絶縁膜は、その上層部分が感光性樹脂からなる平坦化膜であることを特徴とするアクティブマトリクス基板。

【請求項２】　前記第１絶縁膜は、前記ゲート配線及び前記共通配線の上を覆い、かつ、前記ソース配線及び前記ドレイン配線は、前記第１絶縁膜の上に設けられる請求項１記載のアクティブマトリクス基板。

【請求項３】　前記第１絶縁膜は、前記半導体層と同じ形状にパターニングされて第１絶縁膜パターンを構成し、前記ゲート配線及び前記共通配線は、端子部及び終端部以外の領域においては、下面以外の表面を前記第１絶縁膜パターンに覆われている請求項１記載のアクティブマトリクス基板。

【請求項４】　前記第２絶縁膜は、前記ゲート配線の端子部、前記ソース配線の端子部及び前記ドレイン配線の端子部において端子開口部を有する請求項１、２又は３記載のアクティブマトリクス基板。

【請求項５】　前記感光性樹脂は、アクリル樹脂をベースとするものである請求項１、２、３又は４記載のアクティブマトリクス基板。

【請求項６】　前記第３絶縁膜は、配向膜である請求項１、２、３、４又は５記載のアクティブマトリクス基板。

【請求項７】　基板の上に設けられたゲート電極を兼ねるゲート配線及び共通電極を兼ねる共通配線と、前記ゲート配線の上方に第１絶縁膜を挟んで設けられた半導体層と、ソース電極、画素電極を兼ね前記半導体層と接続されるソース配線及びドレイン電極を兼ね前記半導体層と接続されるドレイン配線と、前記半導体層、前記ソース配線、前記ドレイン配線を含む前記基板の表面を覆う第２絶縁膜と、からなり、前記共通電極及び前記ソース配線は、互いに併行するそれぞれ櫛歯状共通電極及び櫛歯状画素電極を有しており、前記櫛歯状共通電極と前記櫛歯状画素電極との間に電圧を印加することにより液晶の向きを制御するアクティブマトリックス基板であって、前記第２絶縁膜は、その上層部分がアクリル樹脂をベースとした感光性樹脂からなる平坦化膜であることを

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特徴とするアクティブマトリックス基板。

【請求項８】　基板の上にゲート電極を兼ねるゲート配線及び共通電極を兼ねる共通配線を形成し、前記ゲート配線及び前記共通配線を含む前記基板を被覆する第１絶縁膜を堆積し、前記第１絶縁膜の上に半導体膜を堆積し、前記半導体膜をパターニングして半導体層を形成し、前記半導体層を含む前記第１絶縁膜の上に金属膜を堆積し、前記金属膜をパターニングして、ソース電極、画素電極を兼ね前記半導体層と接続されるソース配線とドレイン電極を兼ね前記半導体層と接続されるドレイン配線とを形成し、前記半導体層、前記ソース配線及び前記ドレイン配線を含む前記第１絶縁膜を被覆する第２絶縁膜及びその上の第３絶縁膜を堆積するアクティブマトリクス基板の製造方法であって、前記共通配線及び前記ソース配線には、それらの形成時に、互いに併行するそれぞれ共通電極及び画素電極も併せて形成されており、前記第２絶縁膜は、その上層部分が感光性樹脂により形成されるアクティブマトリクス基板の製造方法。

【請求項９】　基板の上にゲート電極を兼ねるゲート配線及び共通電極を兼ねる共通配線を形成し、前記ゲート配線及び前記共通配線を含む前記基板を被覆する第１絶縁膜を堆積し、前記第１絶縁膜の上に半導体膜を堆積し、前記半導体膜及び前記第１絶縁膜を半導体層パターンに合わせて同時にパターニングして、それぞれ半導体層及び第１絶縁膜パターンを形成し、前記半導体層及び前記第１絶縁膜パターンを含む前記基板の上に金属膜を堆積し、前記金属膜をパターニングして、ソース電極を兼ね前記半導体層と接続するソース配線及びドレイン電極を兼ね前記半導体層と接続するドレイン配線を形成し、前記半導体層、前記第１絶縁膜パターン、前記ソース配線及び前記ドレイン配線を含む前記基板を被覆する第２絶縁膜及びその上の第３絶縁膜を堆積するアクティブマトリクス基板の製造方法であって、前記共通配線及び前記ソース配線には、それらの形成時に、互いに併行するそれぞれ共通電極及び画素電極も併せて形成されており、前記第２絶縁膜は、その上層部分が感光性樹脂により形成されるアクティブマトリクス基板の製造方法。

【請求項１０】　前記ゲート配線及び前記共通配線は、端子部及び終端部以外の領域においては、下面以外の表面を前記第１絶縁膜パターンに覆われている請求項９記載のアクティブマトリクス基板の製造方法。

【請求項１１】　前記感光性樹脂は、前記感光性樹脂を塗布、露光、現像、熱処理することにより形成される請求項８、９又は１０記載のアクティブマトリクス基板の製造方法。

【請求項１２】　前記第２絶縁膜は、前記感光性樹脂の下に保護絶縁膜を有する請求項８、９、１０又は１１記載のアクティブマトリクス基板の製造方法。

【請求項１３】　前記ゲート配線の端子部、前記ソース配線の端子部及び前記ドレイン配線の端子部において、

前記感光性樹脂に感光性樹脂開口部を形成し、さらに、前記感光性樹脂開口部を通して前記保護膜に保護膜開口部を形成することにより、前記第２絶縁膜に端子開口部が形成される請求項１２記載のアクティブマトリクス基板の製造方法。

【請求項１４】　前記感光性樹脂は、アクリル樹脂をベースとして形成される請求項８、９、１０、１１、１２又は１３記載のアクティブマトリクス基板の製造方法。

【請求項１５】　前記第３絶縁膜は、配向膜である請求項８、９、１０、１１、１２、１３又は１４記載のアクティブマトリクス基板の製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、液晶表示装置に関し、特に、横電界（ＩＰＳ）方式のアクティブマトリクス基板及びその製造方法に関するものである。

【０００２】

【従来の技術】ガラス基板上に薄膜トランジスタ（Ｔｈｉｎ　Ｆｉｌｍ　Ｔｒａｎｓｉｓｔｏｒ：以下“ＴＦＴ”と略す）をマトリクス状に形成し、これをスイッチング素子として用いるアクティブマトリクス型液晶表示装置は、高画質の平面ディスプレイとして開発されている。

【０００３】従来広く使用されているネマティック（ｔｗｉｓｔｅｄ　ｎｅｍａｔｉｃ：以下“ＴＮ”と略す）型のアクティブマトリクス型液晶表示装置においては、液晶層を駆動する電極は、２枚のガラス基板上に形成して対向させた透明な電極を用いるようにし、電圧印加時の液晶分子が基板表面に平行になっている「白」表示状態から、印加電圧に応じて液晶分子が電界方向に配向ベクトルの向きを変化させていくことにより、「白」表示状態から次第に「黒」表示状態にしている。

【０００４】しかし、この電圧印加の液晶分子の特有の挙動により、ＴＮ型液晶表示装置は視野角が狭いという問題がある。この視野角が狭いという問題は、中間調表示における液晶分子の立ち上がり方向において特に著しい。

【０００５】その液晶表示装置の視野特性を改善する方法として、公表特許平５－５０５２４７号公報に、液晶分子を基板と水平方向に保ったまま回転させるため、２つの電極を共に片方の基板上に設けるようにし、この２つの電極間に電圧をかけて、基板と水平方向の電界を生じさせるようにしたＩＰＳ（Ｉｎ－Ｐｌａｎｅ－Ｓｗｉｔｃｈｉｎｇの略称で、以下、ＩＰＳと記載する。）方式の液晶表示装置が提案されている。この方式では、電圧を印加したときに液晶分子の長軸が基板に対して立ち上がる事はない。このため視角方向を変えたときの液晶の複屈折の変化が小さく、視野角が広いという特徴がある。

【０００６】このように、２つの電極をともに片方の基板上に設けるようにしたＩＰＳ方式のアクティブマトリクス型液晶表示装置に関して以下に説明する。このＩＰＳ方式のＴＦＴ液晶表示装置は、図１１に示すように構成されている。なお、図１１は、図１２の平面図Ｄ－Ｄ’線の断面を示している。

【０００７】まず、ガラス基板６１ａ上にＣｒよりなるゲート電極６２ａおよび共通電極６３ａが形成され、これらの電極を覆うように窒化シリコンからなるゲート絶縁膜６４が形成されている。また、ゲート電極６２ａ上には、ゲート絶縁膜６４を介してアモルファスシリコンからなる半導体膜６５が形成され、トランジスタの能動層として機能するようになされている。

【０００８】また、半導体膜６５のパターンの一部に重畳するようにＣｒよりなるドレイン電極６６ａ、ソース電極６７ａが形成され、これら全てを覆うように窒化シリコンからなる保護膜６８が形成されている。

【０００９】また、図１２に示すように、ソース電極６７ａの延長線としての画素電極７７ａと共通配線６３ｃの延長線である共通電極６３ａとの間に１画素の領域が配置される事になる。そして、以上のように構成された単位画素をマトリクス状に配置したアクティブマトリクス基板の表面には、配向膜７０ａが形成されており、この配向膜７０ａ表面はラビング処理されている。

【００１０】そして、ガラス基板６１ａと対向する対向基板６１ｂが、それぞれの表面に配向膜７０ａ，７０ｂを有し、その配向膜形成面が互いに向き合うようにして対向配置され、これらの間に液晶組成物７１が配置されている。

【００１１】また、ガラス基板６１ａおよび対向基板６１ｂの外側の面には、それぞれ偏向板７４ａ及び偏向板７４ｂが形成されている。

【００１２】なお、カラーフィルタ層７２を区切っている遮光部７３は、その一部の領域が半導体膜６５よりなる薄膜トランジスタ上に配置するように形成されている。

【００１３】以上のように構成されたアクティブマトリクス型液晶表示装置では、液晶組成物に電界がかかっていないときは、液晶分子はそれら電極の並行方向に概略平行な状態の液晶分子７１ａのようになっており、ホモジニアス配向している。

【００１４】すなわち、液晶分子の長軸（光学軸）の方向と、画素電極７７ａと共通電極６３ａとの間に形成される電界方向とのなす角度が、４５°以上９０°未満となるように、液晶分子は配向されている。なお、対向配置されているガラス基板６１ａ及び対向基板６１ｂと液晶分子の配向方向は、互いに平行となっている。また、液晶分子の誘電異方性は正とした。

【００１５】ここで、ゲート電極６２ａに電圧を印加して薄膜トランジスタ（ＴＦＴ）をオンすると、ソース電極６７ａ及び画素電極７７ａに電圧が印加されて画素電

極７７ａとこれに対向配置している共通電極６３ａの間に電界が誘起される。そして、この電界により、液晶分子７１ａは液晶分子７１ｂへと向きを変える。この液晶分子は、画素電極７７ａとこれに対向配置している共通電極６３ａの間に形成される電界の方向に、ほぼ平行な状態となる。そして、偏向板７４ａ，７４ｂの偏向透過軸を所定角度に配置しておくことで、上述した液晶分子の動きによって光の透過率を変化させることができる。

【００１６】このように、このＩＰＳ方式のアクティブマトリクス型液晶表示装置では、透明電極がなくてもコントラストを与えることができる。そして、上述したＩＰＳ方式のアクティブマトリクス型液晶表示装置では、液晶分子の長軸は基板表面とほぼ平行であり、電圧を印加することで立ち上がることがない。このため、視角方向を変えたときの明るさの変化が小さく、視角特性が大幅に改善されるという効果を有している。

【００１７】

【発明が解決しようとする課題】しかしながら、前記したＩＰＳ方式の液晶表示装置では以下に示すような問題が生じる。

【００１８】すなわち、ＩＰＳ方式では印加電界方向と光の透過方向が異なる素子構造であるため、従来から広く用いられているＴＮ方式とは異なり液晶を駆動するための電界を形成する画素電極と対向電極は必ずしも透明である必要はない。実際には抵抗が低く、また容易に形成できるため金属電極を用いることが望ましい。ＩＰＳ方式の液晶表示装置における画素電極と対向電極の両電極は櫛歯状で、互いに櫛歯が挟みあうように形成されており、しきい値電圧が低くてより均一な横電界を得るためには電極配線幅や配線間の距離を緻密に形成する必要がある。

【００１９】しかし、電極配線幅や配線間の距離を緻密に形成する結果として、ＴＦＴ構造に起因する配向不良が発生することが分かった。つまり、液晶を配向させる、すなわち液晶層を構成する液晶分子に配向規制力を付与するために、通常では配向膜にラビング処理を施すが、電極間の高さの関係によってラビングが不足あるいはラビングされないような場所が発生してしまう。その発生場所は、特に電極郡に沿った当該電極群近傍の領域であり、「黒」表示で観察したときに所謂白抜けが発生する。

【００２０】ラビング処理における配向規制力の相違は、電極間の大きさと用いられるラビング布の毛足の太さにあると考えられる。つまり、電極間の段差が小さい部分はラビングされ易く、電極間の段差が大きい場合は配向規制力が異なった場所が生じる。この配向規制力の差により液晶の配向均一性が乱れてしまう。電極の高さが同じである場合は配向規制力が同じになり、配向不良領域は発生しないが、ＩＰＳ方式の液晶表示装置では、電界を発生する画素電極と対向電極とは絶縁層を介した異なる層に形成され、両電極の高さは必然的に異なったものとなるため、配向不良部分が発生する。

【００２１】本発明の目的は、この電極間の高さの違いに起因した配向不良を抑制し、良好なラビング処理ができるＩＰＳ方式のアクティブマトリクス基板及びその製造方法を提供することにある。

【００２２】

【課題を解決するための手段】本発明の第１のアクティブマトリクス基板は、基板の上に設けられたゲート電極を兼ねるゲート配線及び共通電極を兼ねる共通配線と、前記ゲート配線の上方に第１絶縁膜を挟んで設けられた半導体層と、ソース電極、画素電極を兼ね前記半導体層と接続されるソース配線及びドレイン電極を兼ね前記半導体層と接続されるドレイン配線と、前記半導体層、前記ソース配線、前記ドレイン配線を含む前記基板の表面を覆う第２絶縁膜及びその上の第３絶縁膜と、からなり、前記共通電極及び前記ソース配線は、互いに併行するそれぞれ共通電極及び画素電極を有しており、前記共通電極と前記画素電極との間に電圧を印加することにより液晶の向きを制御するアクティブマトリクス基板であって、前記第２絶縁膜は、その上層部分が感光性樹脂からなる平坦化膜であることを特徴とし、前記第１絶縁膜は、前記ゲート配線及び前記共通配線の上を覆い、かつ、前記ソース配線及び前記ドレイン配線は、前記第１絶縁膜の上に設けられるか、或いは、前記第１絶縁膜は、前記半導体層と同じ形状にパターニングされて第１絶縁膜パターンを構成し、前記ゲート配線及び前記共通配線は、端子部及び終端部以外の領域においては、下面以外の表面を前記第１絶縁膜パターンに覆われている、という構成であり、また、前記第２絶縁膜は、前記ゲート配線の端子部、前記ソース配線の端子部及び前記ドレイン配線の端子部において端子開口部を有する、というものである。

【００２３】また、上記第１のアクティブマトリクス基板は、前記感光性樹脂は、アクリル樹脂をベースとするものであり、さらに、前記第３絶縁膜は、配向膜である、というものである。

【００２４】次に、本発明の第２のアクティブマトリクス基板は、基板の上に設けられたゲート電極を兼ねるゲート配線及び共通電極を兼ねる共通配線と、前記ゲート配線の上方に第１絶縁膜を挟んで設けられた半導体層と、ソース電極、画素電極を兼ね前記半導体層と接続されるソース配線及びドレイン電極を兼ね前記半導体層と接続されるドレイン配線と、前記半導体層、前記ソース配線、前記ドレイン配線を含む前記基板の表面を覆う第２絶縁膜と、からなり、前記共通電極及び前記ソース配線は、互いに併行するそれぞれ櫛歯状共通電極及び櫛歯状画素電極を有しており、前記櫛歯状共通電極と前記櫛歯状画素電極との間に電圧を印加することにより液晶の向きを制御するアクティブマトリックス基板であって、

前記第２絶縁膜は、その上層部分がアクリル樹脂をベースとした感光性樹脂からなる平坦化膜であることを特徴とする、というものである。

【００２５】本発明の第１のアクティブマトリクス基板の製造方法は、基板の上にゲート電極を兼ねるゲート配線及び共通電極を兼ねる共通配線を形成し、前記ゲート配線及び前記共通配線を含む前記基板を被覆する第１絶縁膜を堆積し、前記第１絶縁膜の上に半導体膜を堆積し、前記半導体膜をパターニングして半導体層を形成し、前記半導体層を含む前記第１絶縁膜の上に金属膜を堆積し、前記金属膜をパターニングして、ソース電極、画素電極を兼ね前記半導体層と接続されるソース配線とドレイン電極を兼ね前記半導体層と接続されるドレイン配線とを形成し、前記半導体層、前記ソース配線及び前記ドレイン配線を含む前記第１絶縁膜を被覆する第２絶縁膜及びその上の第３絶縁膜を堆積するアクティブマトリクス基板の製造方法であって、前記共通配線及び前記ソース配線には、それらの形成時に、互いに併行するそれぞれ共通電極及び画素電極も併せて形成されており、前記第２絶縁膜は、その上層部分がアクリル樹脂をベースとした感光性樹脂により形成されるというものである。

【００２６】次に、本発明の第２のアクティブマトリクス基板の製造方法は、基板の上にゲート電極を兼ねるゲート配線及び共通電極を兼ねる共通配線を形成し、前記ゲート配線及び前記共通配線を含む前記基板を被覆する第１絶縁膜を堆積し、前記第１絶縁膜の上に半導体膜を堆積し、前記半導体膜及び前記第１絶縁膜を半導体層パターンに合わせて同時にパターニングして、それぞれ半導体層及び第１絶縁膜パターンを形成し、前記半導体層及び前記第１絶縁膜パターンを含む前記基板の上に金属膜を堆積し、前記金属膜をパターニングして、ソース電極を兼ね前記半導体層と接続するソース配線及びドレイン電極を兼ね前記半導体層と接続するドレイン配線を形成し、前記半導体層、前記第１絶縁膜パターン、前記ソース配線及び前記ドレイン配線を含む前記基板を被覆する第２絶縁膜及びその上の第３絶縁膜を堆積するアクティブマトリクス基板の製造方法であって、前記共通配線及び前記ソース配線には、それらの形成時に、互いに併行するそれぞれ共通電極及び画素電極も併せて形成されており、前記第２絶縁膜は、その上層部分が感光性樹脂により形成される、というものである。

【００２７】上記本発明の第１、２のアクティブマトリクス基板の製造方法において、前記ゲート配線及び前記共通配線は、端子部及び終端部以外の領域においては、下面以外の表面を前記第１絶縁膜パターンに覆われ、前記感光性樹脂は、前記感光性樹脂を塗布、露光、現像、熱処理することにより形成され、前記第２絶縁膜は、前記感光性樹脂の下に保護絶縁膜を有し、前記ゲート配線の端子部、前記ソース配線の端子部及び前記ドレイン配線の端子部において、前記感光性樹脂に感光性樹脂開口部を形成し、さらに、前記感光性樹脂開口部を通して前記保護膜に保護膜開口部を形成することにより、前記第２絶縁膜に端子開口部が形成される、という形態を採り得る。

【００２８】また、上記本発明の第１、２のアクティブマトリクス基板の製造方法において、前記感光性樹脂は、アクリル樹脂をベースとして形成され、前記第３絶縁膜は、配向膜である、という形態も可能である。

【００２９】

【発明の実施の形態】本発明の実施形態を説明する前に、本発明の特徴を簡記しておく。

【００３０】本発明の趣旨は、ＩＰＳ方式のアクティブマトリクス基板において、ＴＦＴを覆う保護膜のパターニングを、アクリル樹脂をベースとした感光性樹脂を用いて行い、且つ、そのアクリル樹脂を保護膜の開口後、そのまま平坦化膜として用いることである。

【００３１】図３を用いて説明すると、ガラス基板１上にゲート電極２ａが設けられ、それらを覆うようにゲート絶縁膜４が形成される。その上にゲート電極２ａと重畳するように半導体層５が設けられ、その半導体層５の中央部上で隔てられたソース電極７ａ、ドレイン電極６ａがオーミックコンタクト層（図示無し）を介して半導体層５に接続されている。それらソース電極７ａとドレイン電極６ａの間のオーミックコンタクト層はエッチング除去され、ソース電極７ａ、ドレイン電極６ａと半導体層５の間にのみオーミックコンタクト層（図示無し）が設けられている。さらにオーミックコンタクト層がエッチング除去されたチャネル部を含めて、これらを覆うように保護膜８が設けられ、それらを覆うように平坦化膜９が形成され、さらに、最上層に配向膜１０が形成される。以下の説明においては、簡単のため配向膜の図示は省略している。

【００３２】また、その平坦化膜９の製造方法を簡単に説明すると、ＴＦＴのバックチャネル、ソース電極７ａ、ドレイン配線（図示なし）、ドレイン電極６ａ、ドレイン端子を覆うように形成された保護膜８は端子部分を開口する必要があるため、通常はノボラック樹脂をベースとした感光性レジストを塗布し、フォトレジスト法により端子部の開口を行うが、このノボラック樹脂をベースとした感光性レジストの替わりにアクリル樹脂をベースとした感光性樹脂を塗布する。

【００３３】このアクリル樹脂をベースとした感光性樹脂をフォトレジスト法により、露光、現像を行い、保護膜の開口を必要とする部分のアクリル樹脂を除去する。

【００３４】次に、図５（ａ）、（ｂ）及び図６（ａ）、（ｂ）に示すように、このアクリル樹脂をベースとした平坦化膜９をマスクとして保護膜８の開口を行い、開口後、アクリル樹脂を２３０℃で１時間焼成を行い、そのまま、ＴＦＴ及びドレイン電極の段差などによ

り生じる表面の凹凸を平坦化する平坦化膜９として用いる（図４（ｄ））。なお、アクリル樹脂の感光剤としてポジ型を用いる場合には、アクリル樹脂の透明性を確保するため、焼成前に全面露光を行い、脱色処理を行う。以上の方法によって工程数を増やすことなく、ＴＦＴおよび電極群による凹凸を平坦化したアクティブマトリクス基板を製造することを特徴とする。

【００３５】次に、本発明の第１の実施形態について、図１～６を参照して説明する。本発明の液晶表示装置を、スイッチング素子としてＴＦＴを用いた例を示して説明する。図１は、液晶表示装置におけるアクティブマトリクス基板の構成を示す回路図である。

【００３６】ガラス基板上にゲート配線２ｃおよびドレイン配線６ｃが互いに直交するように配置され、これらの信号線の交差部分に対応するようにＴＦＴ１６および画素容量１７が形成される。ゲート配線２ｃはＴＦＴ１６のゲート電極に接続され、ゲート配線２ｃからゲート電極に入力される走査信号によって画素に対応するＴＦＴ１６が駆動される。

【００３７】ドレイン配線６ｃは、ＴＦＴ１６のドレイン電極に接続され、ドレイン電極へデータ信号を入力する。ＴＦＴ１６のソース電極には櫛歯状の画素電極が接続されてソース配線を構成する。各画素電極は隣接する共通配線３ｃ（共通配線３ｃは共通端子３ｂに導出される。）にゲート絶縁膜を介して重畳し付加容量電極の役割を果たしている。

【００３８】図２は、画素部分の構成を示したものであり、図３は、図２のＡ－Ａ’断面図である。

【００３９】ガラス基板１上にゲート電極２ａが設けられ、それらを覆うようにゲート絶縁膜４が形成される。その上にゲート電極２ａと重畳するように半導体層５が設けられ、その半導体層５の中央部上で隔てられたソース電極７ａ、ドレイン電極６ａがオーミックコンタクト層（図示無し）を介して半導体層５に接続されている。それらソース電極７ａとドレイン電極６ａの間のオーミックコンタクト層はエッチング除去され、ソース電極７ａ、ドレイン電極６ａと半導体層５の間にのみオーミックコンタクト層（図示無し）が設けられている。

【００４０】さらに，オーミックコンタクト層がエッチング除去されたチャネル部を含めて、これらを覆うように保護膜８が設けられ、それらを覆うように平坦化膜９が形成されている。

【００４１】本発明は、ＴＦＴを覆う保護膜８の上に、有機膜からなる平坦化膜９が形成せれているような液晶表示装置であれば適用することが可能であり、平坦化膜９の下にカラーフィルター層あるいはブラックマトリクス層があってもよい。

【００４２】また、スイッチング素子としては特に制限はなく、ＴＦＴに限らずＭＩＭ、ダイオード等であってもよく、また、ＴＦＴとしてもゲート電極が下に位置するような逆スタガード型でなくとも、順スタガード型であってもよい。

【００４３】また、本発明の液晶表示装置では、上記以外の構成については特に制限はなく、例えば液晶材料、配向膜、対向基板、対向電極等は、アクティブマトリクス型液晶表示装置一般に用いられるように構成すればよい。

【００４４】本発明の第１の実施形態の製造方法を、図３の断面図構造を得るための製造工程図として図４～６を用いて説明する。図４は画素表示領域の製造方法、図５はその端子部の構造を示している。

【００４５】図４（ａ）に示すように、例えばガラス基板１上にゲート電極２ａと共通電極３ａを形成する。この形成方法は、従来と同様に、次のように行うことができる。ガラス基板１上にスパッタリングによってＡｌ、Ｍｏ、Ｃｒなどからなる導電層を１００～４００ｎｍの厚さで堆積し、フォトリソ工程によりゲート配線（図示なし）、ゲート電極２ａ、共通電極３ａおよび表示用の外部信号処理基板と接続されるゲート端子２ｂ（図５）を形成する。

【００４６】次に、図４（ｂ）に示すように、シリコン窒化膜などからなるゲート絶縁膜４とアモルファスシリコンからなる半導体層５、n^+アモルファスシリコンからなるオーミックコンタクト層（半導体層５に含め、図示は省略している。）とをプラズマＣＶＤによって、それぞれ４００ｎｍ、３００ｎｍ、５０ｎｍ程度の厚さで連続的に積層し、半導体層５、オーミックコンタクト層とを一括してパターニングする。

【００４７】次に、図４（ｃ）に示すように、ゲート絶縁膜４およびオーミックコンタクト層を覆うようにスパッタリングによってＭｏ，Ｃｒなどを１００～２００ｎｍの厚さで堆積し、これをフォトリソ工程によりソース電極７ａ及びその延長である画素電極１７ａ、ドレイン配線（図示なし）、ドレイン電極６ａ、および表示用の外部信号処理基板に接続されるドレイン端子６ｂ（図６）を形成すると共に、ＴＦＴのチャネル部となるソース電極７ａ及びドレイン電極６ａの直下以外の不要なオーミックコンタクト層を除去する。

【００４８】次に、図４（ｄ）に示すように、ＴＦＴのバックチャネル、ソース電極７ａ、ドレイン配線（図示なし）、ドレイン電極６ａ、ドレイン端子を覆うようにプラズマＣＶＤによりシリコン窒化膜などの無機膜からなる保護膜８を１００～２００ｎｍ程度の厚さで成膜する。

【００４９】この保護膜８は端子部分を開口する必要があるため、通常はノボラック樹脂をベースとした感光性レジストを塗布し、フォトレジスト法により端子部の開口を行うが、本実施形態では、このノボラック樹脂をベースとした感光性レジストの替わりにアクリル樹脂をベースとした感光性樹脂を塗布する。このアクリル樹脂を

ベースとした感光性樹脂をフォトレジスト法により、露光、現像を行い、保護膜８の開口を必要とする部分のアクリル樹脂を除去する。

【００５０】次に、図５（ａ）、（ｂ）及び図６（ａ）、（ｂ）に示すように、このアクリル樹脂をベースとした平坦化膜９をマスクとして保護膜８の開口を行い、開口後、アクリル樹脂を２３０℃で１時間焼成を行い、そのままＴＦＴ及びドレイン電極などの段差による表面の凹凸を平坦化する平坦化膜９として用いる（図４（ｄ））。なお、アクリル樹脂の感光剤としてポジ型を用いる場合には、アクリル樹脂の透明性を確保するため、焼成前に全面露光を行い、脱色処理を行う。

【００５１】その後、通常の方法に従って対向基板と重ね合わせ、液晶を注入して液晶表示装置を完成する。

【００５２】以上説明したように、本実施形態により、ＩＰＳ方式の液晶表示装置において、保護膜の上に平坦化膜を形成することで、ＴＦＴおよびドレイン電極の凹凸に起因したラビング不良を抑制することができる。

【００５３】また、本実施形態では、保護膜の上に形成した平坦化膜をアクリル樹脂をベースとした感光性樹脂より形成することで工程数を増やすことなく平坦化膜の形成を行うことができる。

【００５４】次に、本発明の第２の実施形態について、図７～１０を用いて説明する。図７は平面図を、図８（ａ）は、そのＢ－Ｂ’部の断面図を、図８（ｂ）は、そのＣ－Ｃ’部の断面図を、図９、１０はその製造方法を示している。

【００５５】まず、ガラス基板３１上にゲート電極３２ａ、ゲート配線３２ｃ、共通電極３３ａが設けられ（図９（ａ））、それらを覆うようにゲート絶縁膜３４と半導体層３５が形成され、ゲート電極３２ａ、ゲート配線３２ｃ、共通電極３３ａを覆う領域以外のゲート絶縁膜３４および半導体層３５は除去し、絶縁膜・半導体層積層パターン４２を形成する（図９（ｂ））。その半導体層３５の中央部上で隔てられたソース電極３７ａ、画素電極４７ａ、ドレイン電極３６ａがオーミックコンタクト層を介して半導体層３５に接続されている。それらソース電極３７ａとドレイン電極３６ａの間のオーミックコンタクト層はエッチング除去され、ソース電極３７ａ、ドレイン電極３６ａと半導体層３５の間にのみオーミックコンタクト層（図示無し）が設けられている（図１０（ａ））。さらにオーミックコンタクト層がエッチング除去されたチャネル部を含めて、これらを覆うように保護膜３８が設けられ、更にその上を覆うように平坦化膜３９が形成されている（図１０（ｂ））。

【００５６】この実施形態においては、画素電極４７ａと共通電極３３ａとが同じ平面上に位置することになるので、これらの電極間に電圧が印加されたときの電界が効率よく液晶分子に伝わり、液晶分子の配向性を向上することが出来る。

【００５７】また、本実施形態においては、ガラス基板の上に、ゲート電極、ゲート絶縁膜、半導体層の３つの層が積層されたものが、そのまま段差としてガラス基板の表面の凹凸を生じさせ、第１の実施形態よりも大きな段差が生じるが、このような場合においても、本発明の平坦化膜を用いれば、工程数の増大を伴うことなく、ガラス基板の表面を平坦化することが出来る。

【００５８】

【発明の効果】以上のように、本発明のアクティブマトリクス基板及びその製造方法に従えば、ＩＰＳ方式の液晶表示装置において、保護膜の上に形成した平坦化膜をアクリル樹脂をベースとした感光性樹脂より形成することで工程数を増やすことなく平坦化膜の形成を行うことができ、ＴＦＴおよびドレイン電極の凹凸に起因したラビング不良を抑制することができる。

【図面の簡単な説明】

【図１】一般的な横電界方式液晶表示装置用アクティブマトリクス基板の回路概念図である。

【図２】本発明の第１の実施形態のアクティブマトリクス基板の画素電極近傍の平面図である。

【図３】図２の平面図の切断線Ａ－Ａ’に沿った断面図である。

【図４】本発明の第１の実施形態のアクティブマトリクス基板の製造方法を製造工程順に示す断面図である。

【図５】本発明の第１の実施形態のアクティブマトリクス基板のゲート端子部の電極形成工程を説明する構造断面図である。

【図６】本発明の第１の実施形態のアクティブマトリクス基板のドレイン端子部の電極形成工程を説明する構造断面図である。

【図７】本発明の第２の実施形態のアクティブマトリクス基板の画素電極近傍の平面図である。

【図８】図７の平面図の切断線Ｂ－Ｂ’及び切断線Ｃ－Ｃ’に沿った断面図である。

【図９】本発明の第２の実施形態のアクティブマトリクス基板の製造方法を製造工程順に示す断面図である。

【図１０】図９に続く製造工程を示す断面図である。

【図１１】従来のＩＰＳ方式のアクティブマトリクス基板の構造断面図である。

【図１２】従来のＩＰＳ方式のアクティブマトリクス基板の画素電極近傍の平面図である。

【符号の説明】

１、３１、６１ａ　　ガラス基板
２ａ、３２ａ、６２ａ　　ゲート電極
２ｂ　　ゲート端子
２ｃ、３２ｃ、６２ｃ　　ゲート配線
３ａ、３３ａ、６３ａ　　共通電極
３ｂ　　共通端子
３ｃ、３３ｃ、６３ｃ　　共通配線
４、３４、６４　　ゲート絶縁膜

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５、３５、６５　　半導体層
６ａ、３６ａ、６６ａ　　ドレイン電極
６ｂ　　ドレイン端子
６ｃ、３６ｃ、６６ｃ　　ドレイン配線
７ａ、３７ａ、６７ａ　　ソース電極
８、３８、６８　　保護膜
９、３９　　平坦化膜
１０、７０ａ、７０ｂ　　配向膜
１１、７１　　液晶組成物

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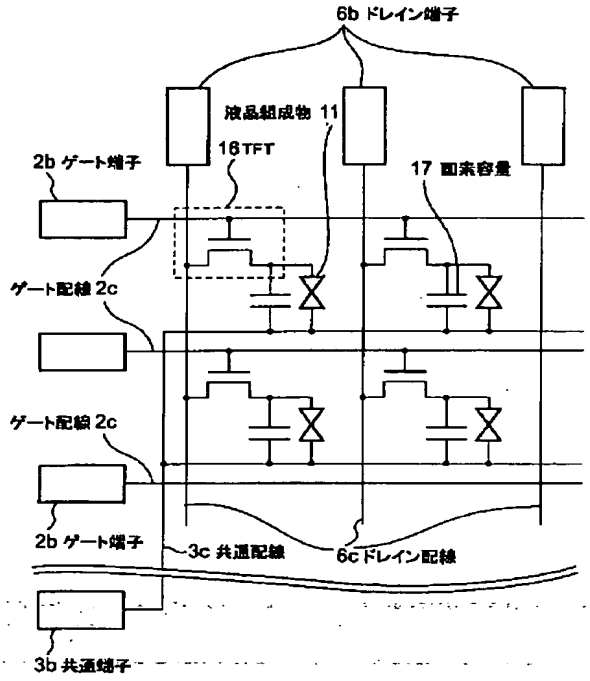
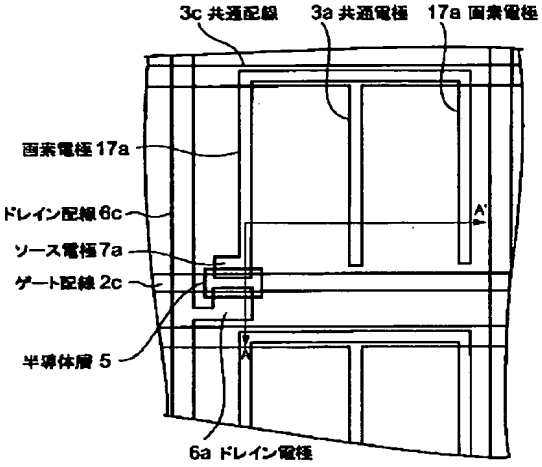
１６　　ＴＦＴ
１７　　画素容量
１７ａ、４７ａ、７７ａ　　画素電極
４２　　絶縁膜・半導体層積層パターン
６１ｂ　　対向ガラス基板
７１ａ、７１ｂ　　液晶分子
７２　　カラーフィルタ層
７３　　遮光部
７４ａ、７４ｂ　　対向基板共通電極

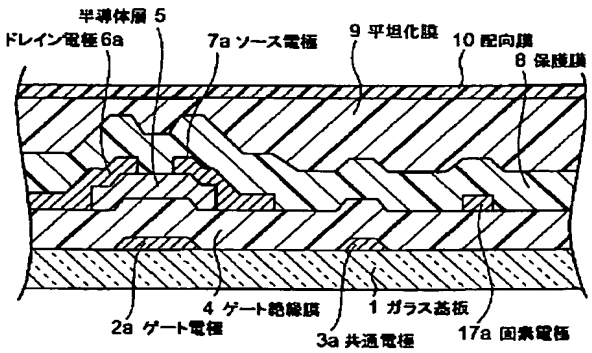
【図１】



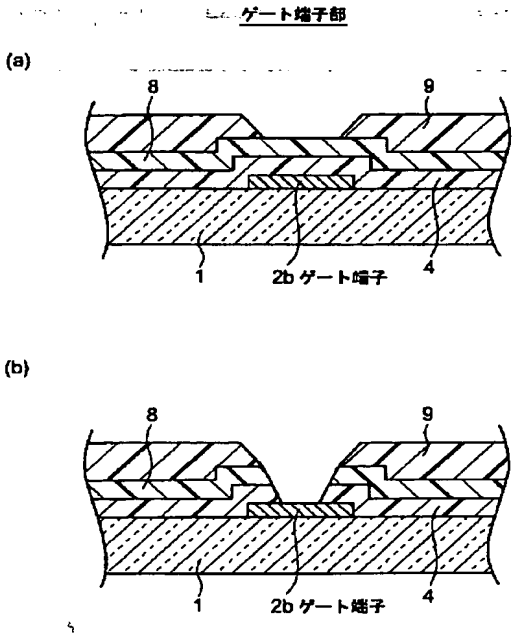
【図２】



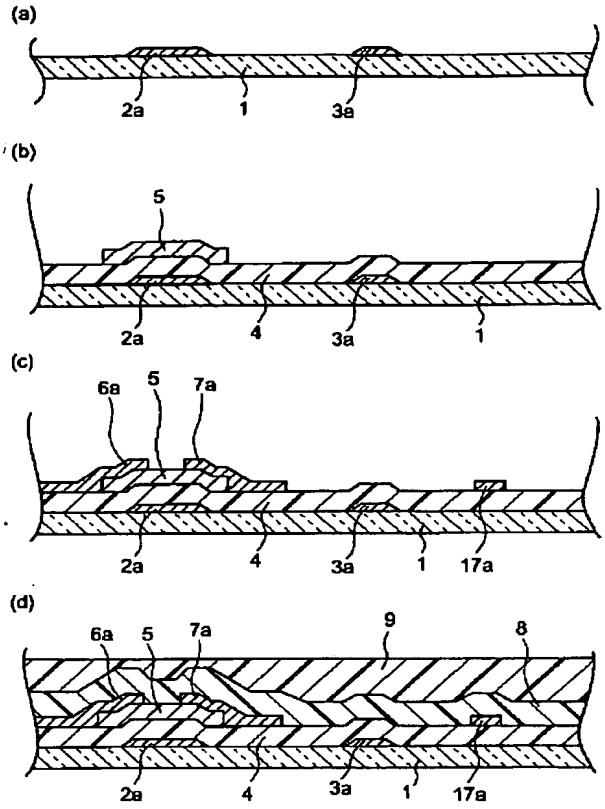
【図３】



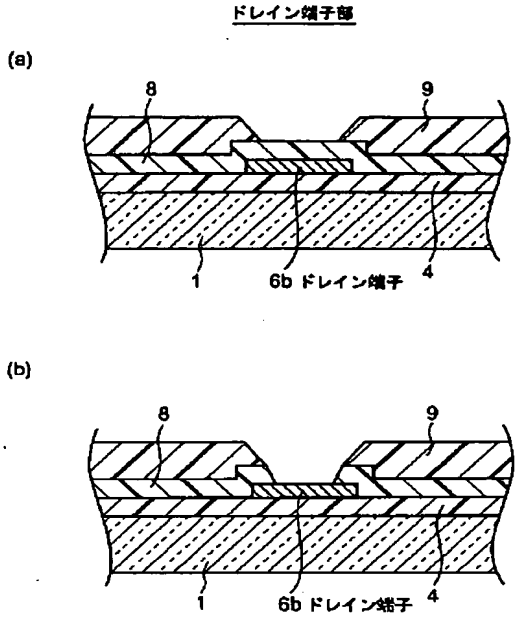
【図５】



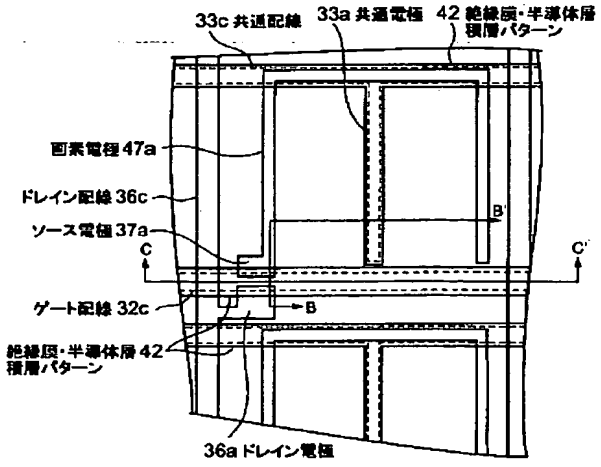
【図４】


(a)
2a
1
3a
(b)
5
2a
4
3a
1
(c)
6a
5
7a
2a
4
3a
1
17a
(d)
6a
5
7a
9
8
2a
4
3a
1
17a

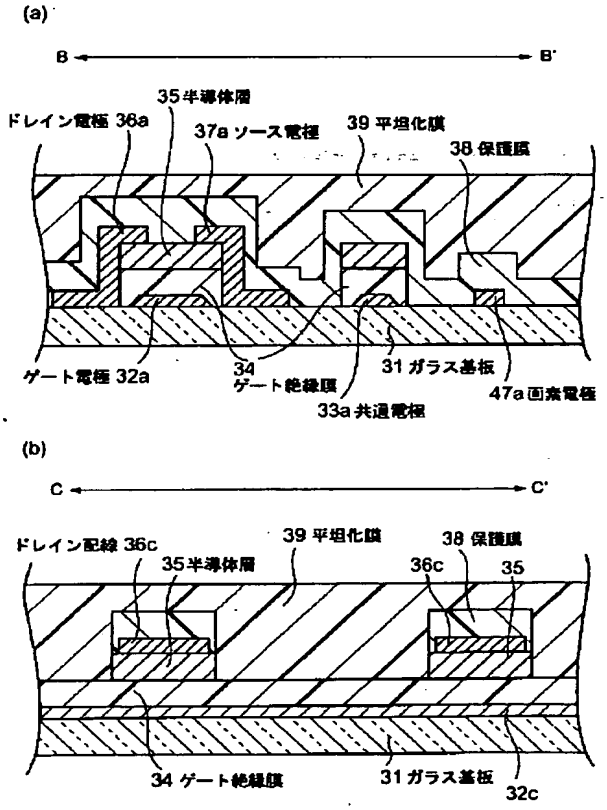
【図６】


ドレイン端子部
(a)
8
9
1
6b ドレイン端子
4
(b)
8
9
1
6b ドレイン端子
4

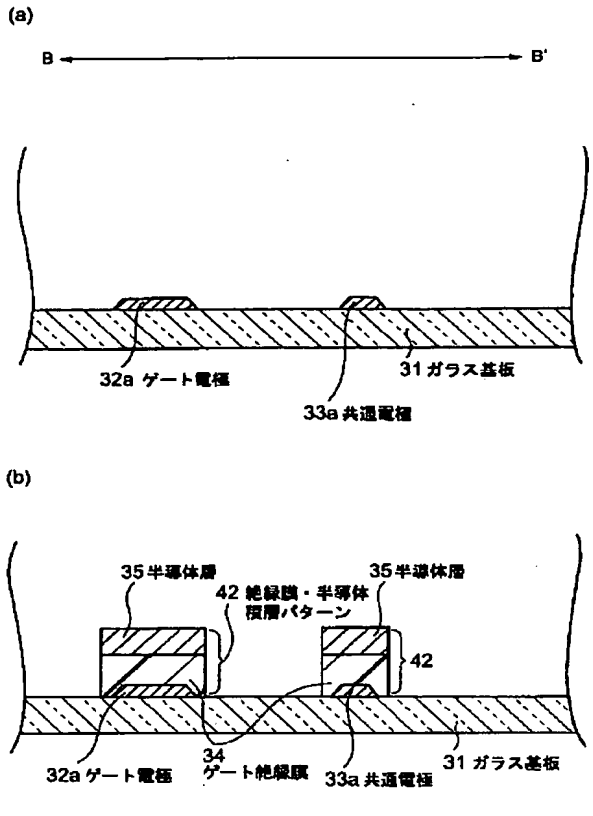
【図７】


33c 共通配線
33a 共通電極
42 絶縁膜・半導体層積層パターン
画素電極 47a
ドレイン配線 36c
ソース電極 37a
B
B'
C
C'
ゲート配線 32c
絶縁膜・半導体層 42 積層パターン
36a ドレイン電極

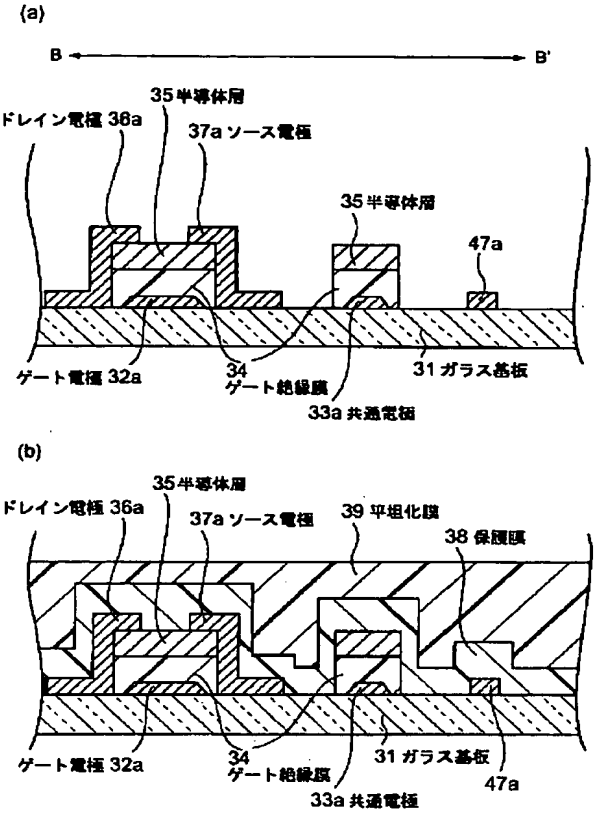
【図８】


(a)
B
B'
35 半導体層
ドレイン電極 36a
37a ソース電極
39 平坦化膜
38 保護膜
ゲート電極 32a
34 ゲート絶縁膜
31 ガラス基板
47a 画素電極
33a 共通電極
(b)
C
C'
ドレイン配線 36c
39 平坦化膜
38 保護膜
35 半導体層
36c
35
34 ゲート絶縁膜
31 ガラス基板
32c

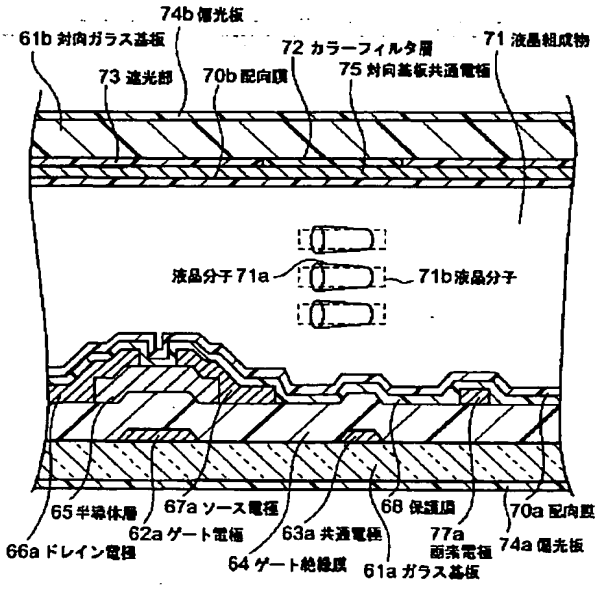
【図９】



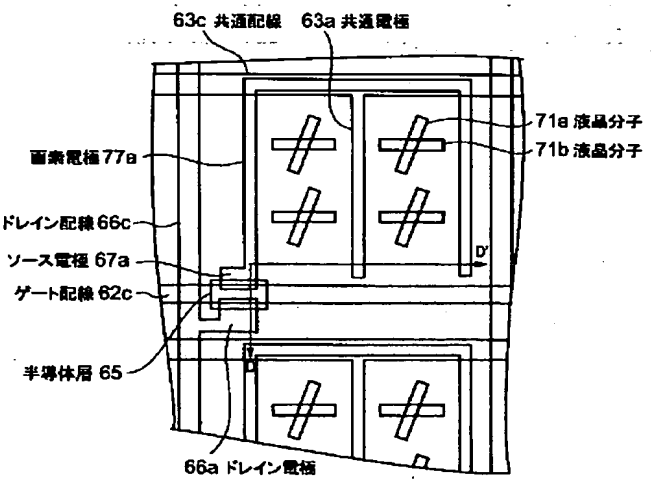
【図１０】



【図１１】



【図１２】



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21/336			６２７Ａ

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HC10 HD03 HD05 LA04
2H092 GA14 JA28 JA37 JA41 JA47
JB22 JB31 JB33 JB37 JB38
JB56 JB57 JB58 KB25 MA13
MA16 MA17 NA04
5C094 AA03 AA12 AA43 AA55 BA03
BA43 CA19 CA24 DA13 DA15
DB01 DB04 EA04 EA10 EB02
ED03 ED14 ED20 FA01 FA02
FB01 FB15 GB10
5F110 AA18 BB01 CC05 CC07 DD02
EE03 EE04 EE44 FF03 FF30
GG02 GG15 GG24 GG45 HK04
HK09 HK16 HK21 HK33 HK35
NN03 NN04 NN24 NN27 NN35
NN72 QQ09 QQ19

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CLAIMS

[Claim(s)]
[Claim 1] The road information by segment to the road segment which constitutes a road system, and the transit information about said road segment classified for every road attribute, An induction path planning means to search for the induction path which computes the business time amount taken to run the path which a car becomes from said road segment from said road information by segment and said transit information, and guides said car based on this duration, Navigation equipment characterized by having a display means to display the induction path for which it was searched in said induction path planning means.
[Claim 2] Transit information is navigation equipment according to claim 1 characterized by the thing which operate a car, and which is classified for every operator.
[Claim 3] Transit information is navigation equipment according to claim 1 or 2 characterized by being the velocity distribution of a car.
[Claim 4] Transit information is navigation equipment according to claim 3 characterized by being a velocity distribution over time amount.
[Claim 5] Transit information is navigation equipment according to claim 3 characterized by being a velocity distribution over distance.
[Claim 6] Navigation equipment of claim 1-5 characterized by having a car situation measurement means to measure the movement condition of a car, and a study means to correct the transit information on said car based on the movement condition measured in said car situation measurement means given in any 1 term.
[Claim 7] The navigation equipment characterized by to have an induction path-planning means search for the induction path which guides said car from the road information by segment to the road segment which constitutes a road system, the break acquisition information about break acquisition of the operator who operates a car, and said road information by segment and said break acquisition information, and a display means display the induction path for which it was searched in said induction path-planning means.
[Claim 8] Break acquisition information is navigation equipment according to claim 7 characterized by asking according to transit of a car.
[Claim 9] Navigation equipment according to claim 7 or 8 characterized by displaying the break acquisition point which searched the break acquisition point and was searched in said induction path planning means in the display means in the induction path planning means from road information by segment and break acquisition information.
[Claim 10] Navigation equipment of claim 7-9 characterized by displaying the facility which searched the facility near the break acquisition point which can be rested, and was searched in said induction path planning means in the display means in the induction path planning means from road information by segment and break acquisition information, and which can be rested given in any 1 term.
[Claim 11] Navigation equipment of claim 7-10 characterized by searching the facility near the break acquisition point which can be rested from road information by segment and break acquisition information, and searching for an induction path in an induction path planning means so that said facility which can be rested may be included in the induction path which guides a car given in any 1 term.
[Claim 12] Navigation equipment of claim 7-11 characterized by having a car situation measurement means to measure the movement condition of a car, and a study means to correct break acquisition information based on the movement condition measured in said car situation measurement means given in any 1 term.
[Claim 13] It is navigation equipment according to claim 6 or 12 characterized by for a car situation measurement means measuring the movement condition of the car at the time of transit in the condition of not performing path planning and of not guiding, and a study means correcting information based on the movement condition measured in the state of no guiding [said].

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] When the destination is set up, this invention relates to the navigation equipment which guides a path and guides a car to the destination exactly while computing the path to the destination.
[0002]
[Description of the Prior Art] Navigation equipment the current position of the car computed by the distance robot, a bearing sensor, GPS (Global Positioning Systems) equipment, etc. It displays on the map around the current position created using the map database which evaluated and recorded the road network. Furthermore, while computing automatically the induction path which connects the point of the destination which the operator set up, the present location the car is running, or arbitration and displaying on said map If a car approaches a crossing, the branch point, etc., with voice, an intersectional enlarged drawing, etc., the action which should be taken next is reported to an operator, at the time of transit of unknown land and unknown Nighttime, a car will be guided safely certainly and facilities will be given to operation. Furthermore, the duration which migration to the destination takes based on the road network data of said induction path in recently is calculated, and the navigation equipment which displays arrival anticipation time of day is offered. (JP,8-313286,A)
[0003] Drawing 38 is a block diagram which expresses the conventional navigation equipment of a publication to above-mentioned JP,8-313286,A. In drawing , it be retrieval range limited equipment which the assignment equipment with which 101 perform a drop and 102 perform assignment of a map display rectangle , assignment of the destination , etc. , the map memory which store the information about the road link whose 103 constitute a road network and a road network , the duration memory in which 104 store the necessary transit time of said road link for every time moon , and 105 compute the slant range which connect a its present location and the destination , and limit the path retrieval range based on this slant range .
[0004] The path retrieval equipment with which the combination of all the road links that arrive at the destination from a their present location based on the road network where 106 is stored in the map memory 103 in said limited range is searched, The path extractor with which 107 extracts the path set corresponding to the shortest time amount path based on the necessary transit time of a road link, The current position detection equipment which 108 computes addition bearing and addition distance accompanying transit, and detects the guess current position, The emphasis signal generation equipment which generates the signal with which 109 carries out highlighting of said shortest time amount path and the guess current position on a road network, 110 is a guide which stores in said duration memory 104 the duration which real-ran each road link while it supplies the signal which carries out highlighting of said shortest time amount path and the guess current position on a road network to a drop 101 and guides a car.
[0005] A liquid crystal display monitor, CRT, etc. are used, and an indicator 101 is moving the cursor as which assignment equipment's 102 was displayed on a touch panel or a remote controller (remote control) being used, and touching on the display on an indicator directly, or an indicator with remote control etc., and specifies the destination, a road network, etc. The map memory 103 consists of mass memory which is digitizing and recording the road map of a predetermined area, and a compact disk (CD-ROM), a hard disk drive (HDD), a magneto-optic-recording disk (MO), etc. are used. The road map recorded on the map memory 103 was represented with the segment which carried out short **** division of the road (road link), and has specified the road network as the aggregate of this road link. Furthermore, this road network is divided, blocked and recorded on the predetermined area.
[0006] The average duration (what averaged and found the duration measured when persons, such as a contractor, ran in the past beforehand) taken for the duration memory 104 to pass through each of this road link corresponding to the road link currently recorded on the map memory 103 is memorized. moreover, the difference of the real duration and average duration which were required when the duration memory 104 actually ran the path set up with path retrieval equipment 106 with the guide 110 explained later to coincidence -- a value is recorded. Retrieval

range limited equipment 105 limits the range of the road network searched with path retrieval equipment 106 using the physical relationship of the destination and a its present location.
[0007] Path retrieval equipment 106 calculates two or more paths in which between the destination and a its present location is connectable, about the road network in the area limited with retrieval range limited equipment 105. The path extractor 107 extracts the optimal path from which the duration which the link passage corresponding to the road link which constitutes each path takes about two or more paths calculated with path retrieval equipment 106 is calculated about each path, and a duration serves as [duration] the shortest in the duration between the destination and a its present location with reference to the duration memory 104.
[0008] current position detection equipment 108 measures the bearing variation of a car -- each -- the current transit location of a car is detected combining the rate sensor which measures an accelerometer and the speed of advance, the GPS equipment which measures a location absolutely using a satellite (neither is illustrated). Emphasis signal generation equipment 109 considers the current position data from current position detection equipment 108 as an input, and generates the signal which displays the current position while it generates the signal which carries out highlighting of the shortest time amount path elected by the path extractor 107. If it approaches the crossing which should carry out a right and left chip box while it outputs the path network of a transit schedule to a drop 101 according to the signal of emphasis signal generation equipment 109 after induction initiation of a path is directed to a guide 110 with assignment equipment 102, it will output the signal which specifies the crossing concerned with means, such as expansion, to a drop 101.
[0009] If an operator specifies the destination with assignment equipment 102 and directs retrieval of a path, path planning equipment 106 will search with the navigation equipment of this configuration the path which connects a its present location to the purpose using the road network of the range limited by retrieval range limited equipment 105. Using the time monthly duration information on the road link memorized by the road link group which constitutes each path, and the duration memory 104 about each path extracted with path planning equipment 106, path planning computes the duration of each whole path according to the time of day when it was commanded, time, a day of the week, etc., and the path extractor 107 extracts the path from which a duration serves as the shortest.
[0010] Furthermore, when said shortest path approaches an applicable crossing, it is specified by the operator with means, such as an enlarged drawing, while being emphasized and displayed on the map displayed on a drop 101 through emphasis signal generation equipment 109 and a guide 110. moreover, when running the induction path top, the actual travel speed of this path measures -- having -- the real duration of a road link -- difference -- it is recorded on the duration memory 104 as information.
[0011]
[Problem(s) to be Solved by the Invention] Although the duration of a road link is found and the shortest path is searched for with conventional navigation equipment using this duration by real transit of the path guided as shown above When running the road link it has never run, since the duration of the road link is not found by real transit, a regular duration will be used, the duration in consideration of each operator's taste is not reflected, and a duration cannot be found correctly.
[0012] Therefore, also in the induction at the time of setting a strange point (point which goes for the first time) as the destination, the duration information on regular is used without reflecting an individual trait, and an individual property cannot be reflected, but there is a fault from which a duration becomes incorrectness. Moreover, also in the road link which had run once, when there are few counts of transit, the duration then found may differ from the duration when an operator runs ordinarily.
[0013] furthermore -- conventional navigation equipment -- the difference of a duration -- information is constituted so that the duration information at the time of the operator according to individual actually running the guided path may be reflected. Therefore, it is only about the road link according to individual applicable to an induction path, and the taste of the travel speed in the case of running in the state of no usual guiding is not reflected.
[0014] Moreover, although it is that it is desirable from **** of a safety operation to acquire a break at suitable spacing at the time of long-distance operation, and only the distance between the destination and a its present location is taken into consideration in the conventional duration count, it is not taken into consideration about acquisition of a break, but there is a fault in which the precision of a duration gets worse as a result.
[0015] It was made in order that this invention might solve this trouble, and it is learning the transit property each operator for every road attribute liking the duration of a road link, and is made for the duration count reflecting an individual trait to be attained also about the path over the non-experienced destination reflecting an individual taste of transit.
[0016] Furthermore, while performing duration count it is possible by learning the break property of the individual at the time of operation, and using this break property to have considered acquisition of a recess and improving the precision of a duration, it aims also at contributing a suitable break stage, a break location, and a break location to a

safety operation by proposing to an operator.
[0017]
[Means for Solving the Problem] The road information by segment to the road segment from which the navigation equipment concerning this invention constitutes a road system, The business time amount taken to run the path to which a car serves as transit information about the road segment classified for every road attribute from a road segment is computed from road information by segment and transit information. [0018] [equipped with an induction path planning means to search for the induction path which guides a car based on this duration, and a display means to display the induction path for which it was searched in the induction path planning means] Moreover, transit information is classified for every road attribute. Furthermore, transit information is classified for every operator who operates a car. Moreover, transit information is the velocity distribution of a car. Furthermore, transit information is a velocity distribution over time amount. Transit information is a velocity distribution over distance further again.
[0019] Moreover, it has a car situation measurement means to measure the movement condition of a car, and a transit property study means to correct the transit information on a car based on the movement condition measured in the car situation measurement means.
[0020] Moreover, it has an induction path planning means to search for the induction path which guides a car from the road information by segment to the road segment which constitutes a road system, the break acquisition information about break acquisition of the operator who operates a car, and road information by segment and break acquisition information, and a display means display the induction path for which it was searched in the induction path planning means. Furthermore, break acquisition information is searched for according to transit of a car.
[0021] Moreover, in an induction path planning means, the break acquisition point which searched the break acquisition point and was searched in the induction path planning means in the display means from road information by segment and break acquisition information is displayed. Furthermore, in an induction path planning means, the facility which searched the facility near the break acquisition point which can be rested, and was searched in the induction path planning means in the display means from road information by segment and break acquisition information and which can be rested is displayed.
[0022] Moreover, in an induction path planning means, the facility near the break acquisition point which can be rested is searched from road information by segment and break acquisition information, and it searches for an induction path so that the facility which can be rested may be included in the induction path which guides a car. Furthermore, it has a car situation measurement means to measure the movement condition of a car, and a break acquisition property study means to correct break acquisition information based on the movement condition measured in the car situation measurement means.
[0023] Moreover, a car situation measurement means measures the movement condition of the car at the time of transit in the condition of not performing path planning and of not guiding, and a study means corrects information based on the movement condition measured in the state of no guiding.
[0024]
[Embodiment of the Invention]
The gestalt of 1 operation of this invention is explained below gestalt 1. of operation. Drawing 1 is the block diagram showing an example of the navigation equipment of the gestalt 1 of operation of this invention. In drawing, 1 is the sensor group which detects the location and movement condition of a car, and consists of yaw rate-sensor 1b which receives the electric-wave signal from a satellite and measures GPS positioning equipment 1a of a car which measures a location absolutely, and bearing change of a car, speed sensor 1c which measures the travel speed of a car.
[0025] A self-vehicle location presumption means to presume the transit location of a car from the location and movement condition of a car that 2 was measured by the sensor group 1, 3 is expressed with the road segment defined by combination with the node showing the always point of the road link which consists the road section of a predetermined segment, and this road link. The map database expressing the road network as the aggregate, 4 compares the transit locus which are the location of the self-car presumed with the self-vehicle location presumption means 2, and its hours history with the road link data constellation near [which was recorded on the map database 3] the presumed self-vehicle location. While determining the road link the self-car is running, it is a road collating means to pinpoint the location of the self-car on the determined road link.
[0026] 6 is the transit property database which memorized the transit property according to the road attribute, and a road attribute expresses the attribute of a road for the classification of the road of a highway, an ordinary road, a main national highway, a national highway, a district path, etc., the breadth of roads, such as 13m or more, less than 13m 5.5m or more, and less than 5.5 etc.m, etc. here.
[0027] It is the user interface means used in order that 7 may input a demand of operators, such as an input of the destination, scrolling of a map, and initiation of path planning, into navigation equipment, and, generally a touch panel, remote control, etc. are used. 8 is a path planning means to search the path which connects the destination

point specified by the user interface means 7, and the self-vehicle location (road link including a self-vehicle location) pinpointed by the road collating means 4 from the road network data of the map database 3, and to memorize this path as the aggregate of a road link.

[0028] 9 is an induction path-planning means compute arrival anticipation time of day by calculating the duration taken to run the whole path from the attribute of a road link and the total extension which constitutes this aggregate, and the transit property of the transit property database 6 corresponding to a road attribute, searching for the optimal path or adding said duration to current time about the aggregate of the path calculated in the path-planning means 8, i.e., a road link.

[0029] 10 reads the road network data of the predetermined range around the location of the self-car presumed with the self-vehicle location presumption means 2, and the location of this presumed self-car from the map database 3. With a display means to display that an operator can understand the road situation of the self-car circumference with a gestalt as shown in a road map While expressing the optimal path set up with the induction path planning means 9 as the technique of emphasizing repeatedly to the map display of said gestalt, arrival anticipation time of day to the duration or destination to the destination computed with the induction path planning means 9 etc. is displayed.

[0030] If it furthermore explains to a detail, the sensor group 1 receives the electric-wave signal sent out from two or more satellites which go the earth around, and is constituted by speed sensor 1c which measures a changed part of a yaw rate-sensor 1b which measures a changed part of GPS positioning equipment 1a which can acquire the LAT LONG and the altitude information of a point on arbitration on the earth and the revolution angular velocity of a car, i.e., an include angle, and the travel speed of a car, i.e., a location.

[0031] A self-vehicle location presumption means 2 presumes the location a car is running by carrying out the comparison reference of the LAT LONG information on the car obtained by GPS positioning equipment 1a, and the positional information acquired by said autonomous navigation while it integrates a changed part of the include angle and the location measured by yaw rate-sensor 1b and speed sensor 1c and computes the location change from a predetermined point with autonomous navigation.

[0032] The map database 3 is disassembled into the aggregate of a link (it is called a road link below) as shows a map as shown in drawing 2 (a) to drawing 2 (b) about the road department, and a node, and what was changed into a vectorization expression like drawing 2 (c) as a road network is memorized. Furthermore, the road network formed into such glue-stock KUTORU is divided and managed in the subsegment of the shape of a mesh as shows the predetermined area a car runs to drawing 3 , and is recorded on the compact disk (CD-ROM), a magneto-optic disk (MO), a hard disk, etc.

[0033] Drawing 4 is drawing showing the DS of the road link explained by drawing 2 , and an example of the DS of the road link which showed drawing 4 (a) with an example of a road link, and showed drawing 4 (b) by drawing 4 (a), and drawing 4 (c) are drawings showing an example of the structure of the road attribute data in DS. As a road link is shown in drawing 4 (a), both ends are usually prescribed by the nodes Ns and Ne with a number, and the link number Ln is given to the segment which connects these nodes Ns and Ne. This road link is recorded by DS as shown in drawing 4 (b) as an example, and the coordinates Xs, Ys, Xe, and Ye showing the location of the node numbers Ns and Ne of the link number Ln, the starting point, and a terminal point, the starting point, and a terminal point node are recorded. The numeric value (generally called a normalization coordinate.) defined in the subdivided partition which is shown in drawing 3 is sufficient as the coordinate of the starting point and a terminal point, and the system of coordinates of a LAT LONG coordinate and others may be used for it.

[0034] Furthermore, the property list of node number Ns-1 of other links which the starting point of the link length L showing the die length of a road link and this road link has connected, Ns+1, node number Ne-1 of other links which the terminal point of a road link has connected, Ne+1, and this road as shown in drawing 4 (c) etc. is recorded.

[0035] A road property list consists of information as shown in drawing 4 (c) as an example. In the road property list of drawing 4 (c), it is recorded that it is a national highway as a classification of a road as an example, 40 km/h is regulation rates, as for this road, 55 km/h has a real vigor rate and the breadth it is [breadth] 10m, the number of lanes is 2 and road attributes, like one-way regulation is made are recorded.

[0036] The transit time which per unit distance takes for every road attribute in a transit property and this case as the transit property database 6 is shown in drawing 5 is memorized. In this case, although the classification in the road property list shown in drawing 4 (c) as a road attribute was used, it cannot be overemphasized that other road attributes, such as the width of street, may be used.

[0037] If the destination is set up by the user interface means 7, the path planning means 8 reads the road network around a its present location and the destination from the map database 3, will select the partition of the map which includes further the road network which connects the destination and a its present location, and, similarly will read the road network included in this partition from the map database 3.

[0038] While displaying as a map the road network which the display means 10 was equipped with graphics

display devices, such as a liquid crystal display panel, and was recorded on the map database 3 When directions of path planning are inputted from the user interface means 7, while it displays the self-vehicle location detected with the self-vehicle location presumption means 2, and piling up and displaying further the search path obtained with the path planning means 8 on said map The duration information computed with the induction path planning means 9 about this search path is displayed on some screens.

[0039] Next, actuation of the navigation equipment shown in drawing 1 is explained. First, in the self-vehicle location presumption means 2, based on the measurement value measured in the sensor group 1, as it is the following, the estimated position of a car is determined. Drawing 6 is drawing explaining the presumed approach of the location of a car. As for the estimated position where 21 was determined by autonomous navigation, the estimated position where 22 was obtained by GPS positioning equipment, and 23, a presumed self-vehicle location and 24 are in drawing, the migration hysteresis, i.e., the transit locus, of the presumed self-vehicle location 23. The present location of the car with which a transit road link and 26 were identified for 25, and 27 are the branch point of a road link, and the focus of the transit locus 28 was presumed to be.

[0040] It asks for the estimated position 21 shown in drawing 6 with autonomous navigation using the estimated position 22 shown in drawing 6 by GPS accumbency equipment 1a, yaw rate-sensor 1b, speed sensor 1c, etc., respectively . Generally, it is rare for both to be in agreement with GPS positioning equipment in autonomous navigation for the reasons of the delay and reflection at the time of signal propagation, installation of an intentional error, etc. for accumulation with error. Then, the presumed self-vehicle location 23 of a car is determined by performing hybrid processing for the estimated positions 21 and 22 called for by the sensor group 1 by the logic of proportional division or others.

[0041] Next, while calling a road network including the position coordinate of the presumed self-vehicle location 23 from the map database 3, the correlation about parameters, such as the presumed self-vehicle location 23 and a location with the transit locus 24, and advance bearing, searches for, and the transit road link 25 where a car consists of a road link it was running in the road link and the past which are carrying out current transit determines in the road collating means 4. And the transit locus 24 and the transit road link 25 of a car are compared, and, finally the current position 26 of a car is identified. the focus (28 [in this case]) corresponding to the description configuration [like the node 27 showing a crossing] whose identification approach of this is -- from the inside of a transit locus -- detecting -- the location of a crossing 27 and the focus 28 -- it is determined by correcting the presumed self-vehicle location 23 using difference.

[0042] On the other hand, when the demand of path planning arises from an operator in the user interface means 7, in the path planning means 8, the path which combined the self-vehicle location and the destination point is searched from the map database 3, and this path is memorized as the aggregate of a road link.

[0043] Next, in the induction path planning means 9, Duration TSG is computed using a formula (1).

[0044]

[Equation 1]

$$T_{SG} = \sum_{\text{道路属性}} \left(\sum_{k} L_{\text{道路属性},k} \cdot T_{\text{道路属性}} \right) \quad \cdots (1)$$

[0045] First, it asks for the sum of the distance of the road for every road attribute from the road link which constitutes the path from the origin set up with the path planning means 8 to the destination. And the duration for every road attribute is computed by multiplying by the sum of the distance for every road attribute of this, and the transit time per unit distance corresponding to that road attribute as shown in drawing 5 . Finally, Duration TSG is computed by asking for the sum of the duration for each [these] road attribute of every. And the optimal path is determined based on this computed business time amount TSG, and this optimal path is displayed on a display with the display means 10.

[0046] An example is explained using drawing 7 . Drawing 7 is an example of the path set up in the path planning means 8, in drawing, S shows the origin of path planning and, as for G, the termination point of path planning and the section display in drawing show the attribute of each road at the destination. Drawing 8 shows the data about the path shown in drawing 7 .

[0047] Drawing 9 is what showed an example of the actuation in a path planning means, in drawing, road network data and [S] are the start points of retrieval, and, in many cases, 31-33 are the current positions of a car. [G] is the destination specified by the user interface means 7.

[0048] First, if the destination is set up and initiation of retrieval is directed by the user interface means 7, the path planning means 8 will read the road network data 31 of the predetermined partition of the retrieval start point circumference, and the road network 32 of the predetermined partition around the destination from the map database 3, as shown in drawing 9 . Furthermore, when the retrieval start point S and Destination G do not exist in

the same map partition, the map partition 33 of a high order including these both partition is read from the map database 3, and the road link train (thick wire in 31, 32, and 33) which connects the retrieval start point S and the destination point G is selected from these road networks.

[0049] Next, if a path as shown in drawing 9 is selected, the road included in a search path will be classified according to a road attribute, and the distance according to road attribute which is total of the distance of the road belonging to the same road attribute will be integrated. And the duration according to each road attribute is computed by carrying out the multiplication of each distance according to road attribute, and the transit property according to each road attribute recorded on the transit property database 6. And Duration TSG is computed by taking the sum of the duration according to each of these road attributes. For example, as shown in drawing 7 R> 7, when a road attribute is a general path, since LR 5 and 1 (7km) and LR 5 and 2 (13km) exist, the partition of a general path computes these sums, and the distance according to attribute of a general path is set to 20km.

[0050] And since the transit property over the attribute of a general path is 0.02564h/km as shown in drawing 8 , the time amount taken to run the section of a general path turns into 20x 0.02564= 0.51 hours. The count same about each road attribute is repeated hereafter, and the duration TSG required to run the entire interval from an origin to the destination is computed by taking these total. (It becomes in 3 hours and 43 minutes in this case) And the optimal path is searched for based on the time amount calculated by this induction path planning means 9, and these are displayed on a display with the display means 10.

[0051] Drawing 10 is what showed an example of a display, it is the display of the location of the map with which 51 is displayed in drawing, and the self-car as which 52 was determined with the self-vehicle location presumption means 2, and the display of the search path to which 53 was set with the path planning means 8, and 54 is the distance to the purpose and the display of a duration for which it opted with the induction path planning means 9. Although considered as the liquid crystal display panel as a display means 10, possible CRT and the possible plasma display of a graphics display, and other devices may be used, and you may make it display a duration on the displays centering on an alphabetic character, such as a dot-matrix display, here.

[0052] Although road attribute information is the classification of a road, the breadth of a road, etc. with the gestalt of this operation, it cannot be overemphasized that road attribute information may be classified for every time amount and every weather in addition to these.

[0053] Although the property data stored in a transit property database with the gestalt of this operation are the time data per unit distance, especially this may not limit and may use rate data instead of time data. In this case, Duration TSG is computed by using a degree type instead of computing Duration TSG by the formula (1).

[0054]

[Equation 2]

$$T_{SG} = \sum_{\text{道路属性}} \left(\frac{\sum_{k} L_{\text{道路属性},k}}{V_{\text{道路属性}}} \right) \quad \cdots (2)$$

[0055] Furthermore, although the property data stored in a transit property database are made to memorize for every road attribute with the gestalt of this operation, especially this does not limit, may be classified according to every operator and such combination, and may be made to memorize.

[0056] The transit property of a road link is not made to memorize for every road link with the gestalt of this operation. [since it has memorized for every road attribute where a road link belongs, when running the road link it has never run] Even if the duration of the road link is not found by real transit, the data of the real transit by the transit data of the same attribute can be reflected, the duration in consideration of each operator's taste can be found, and an exact duration can be found. That is, also in the induction at the time of setting a strange point (point which goes for the first time) as the destination, an individual trait is reflected and an exact duration is acquired.

[0057] Moreover, since a transit property is used for every property of each operator, even when a different operator uses the same car, the exact business time amount prediction reflecting each operator's property is attained.

[0058] Gestalt 2. drawing 11 of operation is drawing showing the navigation equipment of the gestalt 2 of operation of this invention. In drawing, in order that 5 may correct a road attribute extract means to extract the road attribute showing the attribute of the road currently recorded along with the road link determined with the road collating means 4, the transit-6 property (transit time per unit distance) according to a road attribute, and a transit property, it is the transit property database which memorized the time amount table for every attribute.

[0059] 11 is a transit property study means to correct the data of the transit property memorized by the transit property database 6 from the movement situation searched for with the self-vehicle location presumption means 2 based on the measurement value measured in the sensor group 1, and the attribute value of the road link under transit extracted with the road attribute extract means 5. Since others are the same as what was explained by

drawing 1 of the gestalt 1 of operation, explanation is omitted.
[0060] Drawing 12 illustrates the National Expressways time amount table which is a time amount table in case an attribute is National Expressways. The National Expressways time amount table consists of addition time amount and integrated mileage, addition time amount is what integrated the old transit time, and mileage is also newly ******** to old mileage about the mileage it ran in the transit time. In addition, although the case where an attribute is National Expressways here is explained, it has same composition also about other road attributes.
[0061] With the gestalt of this operation, since it is the same as that of the gestalt 1 of operation except correcting the data of a transit property in the transit property study means 11, other explanation is omitted.
[0062] Drawing 13 is the flow chart Fig. having shown the contents of processing of the transit property study means 11 of the navigation equipment shown in drawing 11 . In addition, this processing is started to predetermined timing. First, the attribute of the road under transit detected with the road attribute extract means 5 is inputted. (S101)
Next, the duration and mileage which transit of a road took based on the information on the operation situation of the car called for in the self-vehicle location presumption means 2 are inputted. (S102)
[0063] And the attribute of the road attribute inputted by S101 is judged, and the process processed by S104 according to the road attribute under transit is changed. (S103)
Next, the addition value and mileage of time amount it ran are newly added for every road attribute judged by S103, and a transit property is updated. (S104)
The case where it classifies according to the gestalt of this operation as an example of the attribute of the road processed by S104 independently [National Expressways, the path only for automobiles, a main national highway, a national highway, a principal prefectural road, and six sorts of general paths] is shown.
[0064] Next, the transit time per unit distance average as a transit characteristic value for every road attribute (transit property) is computed from the relation of the transit time and mileage which were integrated by S104. (S105)
And the transit characteristic value of the transit property database 6 is updated with the newest transit characteristic value computed by S107. (S106)
Finally, it prepares for next study processing, a transit addition time amount timer is initialized, and this processing is ended. (S107)
[0065] In addition, these study processings may be performed in the condition of performing path planning which was explained with the gestalt 1 of operation, and you may make it make only the above-mentioned study perform in the condition that path planning is not performed.
[0066] Although it identifies and memorizes for every road attribute with the gestalt of this operation The information on the transit property memorized by the transit property database 6 may make the information learned by the transit property study means 11 identify and memorize for every operator, and You may store in a card etc. each operator's transit property computed beforehand, and may also read the information on this card into a transit property database.
[0067] In the navigation equipment of the gestalt 2 of this operation, since it corrects by learning according to the attribute of the road which is running an operator's transit property, a transit property is corrected according to an operator's transit, and the exact duration prediction which reflected the individual property more is attained. Moreover, since the transit property at the time of the transit which is not guided [to which path planning is not carried out] is also taken into consideration, the taste of the travel speed in the condition of not performing path planning and of usual not guiding can also be reflected.
[0068] The gestalt 3 of operation of gestalt 3. this invention of operation is not the transit time per [as showed the transit property of the transit property database in the navigation equipment shown in drawing 11 of the gestalt 2 of operation to drawing 5] unit distance, and is made into a rate.
[0069] In order that drawing 14 may correct the transit property (rate) and transit property which are memorized by the transit property database of the gestalt of this operation, it is drawing having shown the time amount table for every attribute, and an example of a time amount table for drawing 1414 (a) to correct a transit property and for drawing 14 (b) correct a transit property and drawing 14 (c) show the relation between a travel speed and the addition transit time. The transit property of the gestalt of this operation is expressed at the rate into which the transit property was classified for every road attribute, as shown in drawing 14 (a). Moreover, when it is what showed the relation between rate attribute value, addition time amount, and a time amount ratio, for example, a road attribute is National Expressways, according to a travel speed, it classifies with two or more rate attributes, addition time amount is found for every classified rate attribute of this, and the time amount table shows further the time amount ratio which each rate attribute occupies to a full speed attribute, as shown in drawing 14 (b).
[0070] And addition time amount is found by integrating predetermined time, whenever rate attribute value and road attribute value are changed. In the example shown in drawing 14 , the addition transit time of National Expressways has most transit by the travel speed 100 - 120 km/h, and in other words, it turns out that this operator

likes this rate band, uses, and is running in transit of National Expressways. In addition, these time amount tables consist of tables of a road attribute and the same number.
[0071] With the gestalt of this operation, the transit property study means 11 which showed the transit property in drawing 11 in connection with having made it the rate associates the road attribute under transit extracted with the road attribute extract means 5, and the travel speed of the car called for with the self-vehicle location presumption means 2, learns frequency, and determines the transit property for every road attribute. And the transit property over each attribute of the learned road link is memorized in the transit property database 6.
[0072] Similarly, also in the induction path planning means 9, it is not from a formula (1) like the gestalt 2 of operation, and Duration TSG is computed using the formula (2) shown with the gestalt 1 of operation.
[0073] Drawing 15 is the flow chart Fig. having shown the contents of processing of the transit property study means 11. In addition, ****** is started to predetermined timing. First, the attribute of the road under transit detected with the road attribute extract means 5 is inputted. (S201)
Next, the travel speed of the car called for with the self-vehicle location presumption means 2 is inputted. (S202)
And based on the travel speed called for by S202, the rate attribute to which the rate of the car which is carrying out current transit belongs is determined. (S203)
[0074] Next, in processing of transit property study, the comparison with the attribute of the travel speed detected last time and the attribute of the rate by which current detection was carried out is performed. As a result of a comparison, if the rate attribute is changing, S206 will be performed, and if there is no change of a rate attribute, S205 will be performed. (S204)
In S205, if the comparison with the road attribute which is carrying out current detection with the attribute of the road it was running when processing of transit property study was started by last time is performed and there is no change of a road attribute about the road attribute of the road under transit inputted by S201, subsequent processings will be ended noting that it is unnecessary. When judged with there having been change of a road attribute, it shifts to S206.
[0075] In S206, the attribute of the road attribute inputted by S201 is judged, and the process processed by S207 according to the attribute of the road under transit is changed. In S207, the addition value of the time amount it ran with the rate attribute value determined by S203 is updated for every road attribute judged by S206. The case where it classifies according to the gestalt of this operation as an example of the attribute of the road processed by S207 independently [National Expressways, the path only for automobiles, a main national highway, a national highway, a principal prefectural road, and six sorts of general paths] is shown.
[0076] In S208, a travel speed average as a transit characteristic value for every road attribute is computed using a statistical method from the relation of the rate attribute value and addition time amount which were integrated by S207. This travel speed should just make 95 km/h the transit characteristic value in an express way as an arithmetic average, when it becomes travel-speed frequency distribution like drawing 14 (b). Or as a most frequency value, it is good also as a transit characteristic value in an express way, and the rate attribute V5 (attribute median of 110km/h) may be searched for by other standard deviation count etc.
[0077] Furthermore, in S209, the transit property database 6 is updated with the newest transit characteristic value acquired by processing to S208. In S210, by processing to the above, since study of the transit property corresponding to change of rate attribute value and change of road attribute value was completed, it prepares for next study processing, a transit addition time amount timer is initialized, and this processing is ended.
[0078] Drawing 16 is the decision of the rate attribute of S203, and an explanatory view about calculation of the transit time in each rate attribute. drawing 16 -- setting -- an axis of abscissa -- time amount and an axis of ordinate -- a travel speed -- expressing -- further -- as the example of a rate attribute -- a travel speed -- 20 or more km/h every [//h / less than] 20 km/h, i.e., 20km, and less than 40 km/h, and ** -- the range is set up like and the predetermined range where the travel speed of a car is contained is made into the rate attribute in the condition. The transit time for every rate attribute measures elapsed time deltaT from the time (a points of drawing 16) of the travel speed of a car going into the speed range (for example, rate attribute V5) of a predetermined attribute to the time (b points of drawing 16) of deviating from the speed range of this attribute with a timer (not shown).
[0079] Moreover, even if it is in the same rate attribute, when the road attribute it is running changes, measurement of elapsed time is ended when a road attribute changes (c points of drawing 16), and the elapsed time measurement about a new road attribute (for example, R1) is started. Henceforth, when the road of R1 attribute continues, elapsed time measurement of this rate attribute (for example, V4) is ended at the changing point (d points of drawing 16) of a rate attribute.
[0080] The example of such actuation is explained using drawing 7 . Drawing 17 shows the data about the path shown in drawing 7 . First, the road included in the search path of drawing 7 is classified according to a road attribute, and the distance according to road attribute is integrated. Next, by doing the division of each distance according to road attribute with the transit property according to each road attribute recorded on the transit property database 6 (rate), the duration according to each road attribute is computed, and Duration TSG is computed by

taking total of these durations. For example, since the distance according to attribute of National Expressways shown in drawing 7 is 120km (LR 0 and 1) and the transit properties over the National Expressways attribute are 95 km/h, the time amount taken to run the section of National Expressways turns into 120 / 95= 1.26 hours. The count same about each road attribute is repeated hereafter, and the duration TSG required to run the entire interval from an origin to the destination is computed by asking for these total. Since others are the same as that of what was explained with the gestalt 2 of operation, explanation is omitted.

[0081] In the navigation equipment of the gestalt of this operation, since it corrects by learning according to the attribute of the road which is running the travel speed of a car, i.e., an operator's transit property, in the usual run state, a transit property is corrected according to an operator's transit, and the exact duration prediction which reflected the individual property more is attained.

[0082] The gestalt of other operations of gestalt 4. this invention of operation is explained. Addition distance is used instead of addition time amount, and a transit property is made to correct by these with the gestalt of this operation to making the transit property correct based on addition time amount, as the gestalt 3 of operation showed drawing 14 (b). About other actuation, since it is altogether the same as that of the gestalt 3 of operation, explanation is omitted. Drawing 18 is drawing having shown the flow chart of the processing in the transit property study means 11 of the gestalt 4 of operation of this invention. Since S301 and S302 in drawing 18 are the same as that of S201 and S202 of drawing 15 of the gestalt 3 of operation, they omit explanation.

[0083] Drawing 19 is an explanatory view about the decision of the rate attribute of S303 in the transit property study means 11 in the gestalt 4 of this operation, and the mileage calculation in each rate attribute. In drawing 19 , it is the same as that of drawing 16 of the gestalt 3 of operation except an axis of abscissa expressing mileage and an axis of ordinate expressing a travel speed. The mileage for every rate attribute measures mileage deltaL from the time (a points of drawing 19) of the travel speed of a car going into the speed range (for example, rate attribute V5) of a predetermined attribute to the point (b points of drawing 19) which deviated from the speed range of this attribute with a mileage register (not shown).

[0084] Moreover, even if it is in the same rate attribute, when the road attribute it is running changes, measurement of distance is ended when a road attribute changes (c points of drawing 19), and the elapsed time measurement about a new road attribute (for example, R1) is started. Henceforth, when the road of R1 attribute continues, elapsed time measurement of this rate attribute (for example, V4) is ended at the changing point (d points of drawing 19) of a rate attribute. Hereafter, only the difference of internal processing is explained about S304 to S309.

[0085] Drawing 20 shows the example about the National Expressways rate table of S306 in drawing 18 . Drawing 20 (a) is what showed the relation between rate attribute value, addition mileage, and a distance ratio, and finds addition mileage by integrating mileage deltaL for which it asked by processing of S303 whenever rate attribute value and road attribute value were changed. In the example shown in drawing 20 , the addition mileage of National Expressways has most transit by the travel speed 100 - 120 km/h, and it turns out that this rate band is liked and used.

[0086] Elapsed time becomes long, so that it runs at a low speed, and the difference between the gestalt of this operation and the gestalt 1 of operation is in the point which serves as weighting equal from a low speed to a high speed in the case of the distance base to property calculation which carried out weighting to the low-speed rate band being performed, when calculating in a hourly base.

[0087] Drawing 21 is the explanatory view of the above-mentioned difference. For example, supposing it runs at the rate of 50 km/h, running the distance of 80km freely [km //h / 90], and following remaining 20km on other vehicles about the 100km section as shown in drawing 21 (a), the rate table in this case will serve as drawing 21 (b). If 31% and the rate attribute V4 calculate with the distance base to the rate attribute V2 becoming 69% if a transit property is calculated about the above-mentioned conditions in a hourly base, it will become 20% and 80%, respectively. That is, it is a solution or ** that weight is attached to a low-speed side in a hourly base. Therefore, the direction of the latter which can reflect well the result it ran in the free condition is considered to be suitable for reflecting an individual property.

[0088] In S310, like three gestaltS210 of operation, by processings from S301 to S309, since study of the transit property corresponding to change of rate attribute value and change of road attribute value was completed, a mileage register is initialized in preparation for next study processing, and this processing is ended.

[0089] In the navigation equipment of the gestalt of this operation, in study of each operator's transit property in the usual run state, since the distance which ran study of a transit property with the travel-speed attribute is integrated and calculated and this is memorized as a transit property database according to road attribute, in addition to the gestalt 3 of operation, the exact duration prediction which reflected the individual property more is attained.

[0090] Gestalt 5. drawing 22 of operation is drawing showing the configuration of the navigation equipment of the gestalt 5 of operation of this invention. In drawing, 6 is a transit property database which memorizes as a database the property of the break acquisition of an operator learned by the break property study means 13 in addition to the

actuation in the navigation equipment shown in drawing 11 of the gestalt 3 of operation.
[0091] 9 is an induction path planning means to calculate the total duration in consideration of the time amount which the count of a break and a break take in the case of duration count while calculating the count of the break which should be acquired in case it runs the path for which it was searched from the property of the break acquisition currently recorded on the transit property database 6 in addition to the actuation in the navigation equipment of drawing 11 .
[0092] It is a break property study means input a display means to by_which 10 displays the distance to the destination, a duration, recommendation break time of day, etc. in addition to the display of a map or a search path, a break judging means to by_which 12 judges a break situation from the run state of a car using the information on the self-vehicle location presumption means 2 and the road collating means 4, and the break situation that 13 was obtained with a break judging means 12, and learn an operator's break property. Since others are the same as that of actuation of the navigation equipment explained by drawing 11 of the gestalt 3 of operation, explanation is omitted.

[0093] Next, actuation of the gestalt of this operation is explained. Since the gestalt of this operation is the same as the gestalt 3 of operation except using a break property, other explanation is omitted. Based on the result judged in the break judging means 12, the break property of a transit property database is learned in the break property study means 13, and how these characteristic values perform path planning is explained in an induction path planning means.
[0094] First, in the break judging means 12, an operator presumes whether it is in the condition of a break by judging whether a car exists on a current road link from physical relationship with the road judged with the movement condition and the road collating means 4 of the car currently measured with the self-vehicle location presumption means 2.
[0095] Next, in the break property study means 13, the property of break acquisition of each operator is learned from the break condition and recess information which were judged with the break judging means 12. The transit duration the car is continuing and running as a property of break acquisition here, for example, the break acquisition time amount which is performing the break are mentioned. Drawing 23 is the explanatory view of the outline of a break acquisition property, in drawing, an axis of abscissa is time amount, an axis of ordinate is the vehicle speed, and the curve in drawing shows the travel-speed pattern of a car. First, a break acquisition property measures the break acquisition time amount Trest after starting the transit duration Trun after starting transit until it starts a break, and a break until it resumes transit. And by processing these measurement values statistically, a break acquisition property is determined and it records on the transit property database 6.
[0096] And in the induction path planning means 9, a duration is computed as follows. Drawing 24 is drawing showing the example of the duration calculation in the induction period retrieval means 9. In drawing, drawing 24 (a) is an example of the transit property database 6 in the gestalt of this operation, and adds a break acquisition property to the transit property database in the gestalten 3 and 4 of operation. In the case of drawing 24 (a), this operator's average transit duration is 20 minutes per hour, and it means having acquired the break for 15 minutes on the average.
[0097] Drawing 24 (b) is what showed the count result in the duration count in the gestalt of this operation, and that of the search path for duration count and other conditions is the same as that of the example of duration count in the gestalt 3 of operation. As the gestalt 3 of operation explained from the transit property according to the road distance of an entire interval, and road attribute, when a duration is calculated, 3 hours and 43 minutes are needed.
[0098] Moreover, since the average transit duration recorded on this operator's transit property database is 20 minutes per hour, it is desirable [this section] to divide and run at the three sections, as shown in drawing 2424 (b) so that it may agree in this operator's transit property. And since it is attached to one break and 15 minutes is required in order to divide as mentioned above and to run, the duration to which it runs this section in the case of this operator will require after all 4 hours and 13 minutes which added 30 minutes of a recess in 3 hours and 43 minutes.
[0099] Drawing 25 is drawing having shown an example of processing of the break judging means 12. In addition, this processing is started by predetermined timing. The contents of processing are explained below. First, the movement condition of the car which makes passing speed of a car representation from the self-vehicle location presumption means 2 is inputted. (S401)
Next, the physical relationship of the location of a collating condition with a road, i.e., a current self-car, and a road link is inputted from the road collating means 4. (S402)
[0100] And the road collating condition of having been inputted by S402 is judged by being attached to whether a car exists on a current road link. If judged with a path on the street, the following processings will be omitted and this processing will be ended. If it separates from the outside of a road, i.e., a road link, and a car exists in a certain facility and a parking lot etc., S404 will be performed noting that there is possibility of a break. (S403)
In S404, a car judges whether it is under [transit] ****** from the movement condition of the car inputted by

S401. If judged with under transit, S408 will be performed in order to judge whether it is running under transit or outside a road the road where the car is not recorded on a map database, or it is resumption of transit after a break. Moreover, S405 will be performed if judged with it being under halt.
[0101] In S405, after this processing is started, in order to judge whether it is in the first break candidate condition, a break judging flag is inspected. If a break judging flag is setting ending, the following processings will be omitted noting that it is already in a break candidate's condition, and this processing will be ended. If a break judging flag has not been set up, it will suppose that it is in the first break candidate condition, and S406 will be performed. In S406, since it was judged with it being in a break candidate condition by old processing, in order to start measurement of a recess, a timer is started and the break judging flag for memorizing that it is in the condition in early stages of a break candidate by S407 is set up.
[0102] if a break judging flag is inspected and a flag has not been set up in S408 -- the outside of a road, and data -- evil principles -- it judges that a way is under transit and this processing is ended. If a flag is setting ending, it will judge that it is transit initiation after a break, and S409 will be performed. In S409, a recess is measured from the timer started by S406, and a timer is initialized. In S410, it prepares for the next break judging and a break judging flag is canceled.
[0103] The navigation equipment of the gestalt of this operation learns the time amount it runs continuously, and the time amount which a break takes. It constitutes so that this may be memorized as a break acquisition property in a transit property database. Calculation of the duration which transit of the search path to the destination from an origin takes Since it is constituted so that duration calculation may be performed in consideration of the recess which performs duration calculation reflecting each operator's usual transit property, and should be contained in a duration Duration count it is possible to have considered acquisition of a recess can be performed, while the exact duration prediction reflecting an individual property is attained, a suitable break stage can be proposed to an operator, and it becomes possible to contribute also to the improvement in safety.
[0104] Moreover, in the gestalt of this operation, although the transit property is learned for time amount as criteria of a property like the gestalt 3 of operation, a transit property may be learned for distance as criteria of a property like the gestalt 4 of operation of this. In this case, while there is an advantage which can specify an operator's transit property correctly more, there is an advantage which can carry out the outline judging of whether should make it contrast with all paths and a break should be taken at which point.
[0105] Although the break judging means 12 in the gestalt 5 of gestalt 6. implementation of operation is constituted so that a recess may be judged only by the condition judging of a halt and a renewal in transit road outside, it makes it judge with the gestalt of this operation according to the merits and demerits of a recess in addition to this whether it is a break. Since others are the same as that of the gestalt 5 of operation, explanation is omitted.
[0106] Drawing 26 is the flow chart Fig. showing processing of the break judging means 12 in the gestalt of this operation. In drawing 26 , since actuation of S501 to S510 is the same as that of S401 to S410 of drawing 25 of the gestalt 5 of operation, detailed explanation is omitted. In S511, the comparison with the recess measured by S509 is performed, and compatibility is judged to be the predetermined value of the recess specified beforehand. For example, the measured recess is shorter than a predetermined value, when it cannot be judged as a break, it considers as nonconformance, and the recess data measured in S512 this time are canceled, and S510 is performed. When the measured recess suits the conditions of a break for a long time than a predetermined value, in preparation for measurement, a break judging flag is canceled next time by S510, and this processing is ended.
[0107] In the navigation equipment constituted as mentioned above, it becomes possible to measure a recess, without being influenced by slight stopping on the way, slight halt in an automatic vending machine etc., etc., and it becomes possible to improve the study precision of a transit property.
[0108] Furthermore, in a user interface means, a house location and the location of the destination are set up, the positional information of this set-up house location or the destination and the positional information of the car measured with the self-vehicle location presumption means are used, and if it constitutes so that parking at a break and a house and parking at the destination can be distinguished clearly, the precision of study will improve more.
[0109] Moreover, when very short-distance migration, such as everyday shopping, is used abundantly, it is predicted that the average transit duration or average endurance distance of a transit property database becomes smaller than an original characteristic value. Then, in order to avoid such fault, you may constitute so that it may perform, only when path planning has a recess learned.
[0110] Gestalt 7. drawing 27 of operation is drawing showing the navigation equipment of the gestalt 7 of operation of this invention. In drawing, 10 is a display means in addition to actuation of the gestalt 5 of operation to have piled up the recommendation break point set up on the search path, and to display it in the case of a map display. 14 is a break recommendation point setting means to compute a recommendation break point using the break acquisition property recorded on the transit property database 6, and the transit property according to road attribute from the search path between the predetermined grounds calculated with the path planning means 8. Since others are the same as that of the gestalt 5 of operation, explanation is omitted.

[0111] Next, actuation of the gestalt of this operation is explained. In the gestalt of this operation, it asks for a break recommendation point in the break recommendation point setting means 14, and in the display means 10, since it is the same as that of the gestalt 5 of operation except displaying this break recommendation point, other explanation is omitted. It attaches and explains to actuation of the break recommendation point setting means 14.
[0112] The break recommendation point setting means 14 inputs the distance of a road attribute and this road attribute from the path planning means 8 about the path by which a sequential setup of [from an origin to the destination] was carried out. Furthermore, the transit property about this road attribute is inputted from the transit property database 6, and the time amount and the addition time amount from an origin which are taken to run the section of this road attribute are calculated. For example, in the case of a path as shown in drawing 7 , data like drawing 28 (a) are obtained.
[0113] In drawing 28 (a), the road attribute of each of this section and the 3rd line of the section number as which the 1st line expresses the section of the specific attribute from an origin, and the 2nd line are the block distances of this section, and these data are obtained from the search-path information on the path planning means 8. The 4th line is a transit property (specifically travel speed) for every road attribute inputted from the transit property database 6. The 5th line is the section transit time taken to run each section, and it can ask for it by doing the division of the block distance obtained with the path planning means 8 with the transit characteristic value currently recorded on the transit property database 6. The 6th line is the accumulation transit time used for duration prediction.
[0114] Next, the calculation approach of the break recommendation point in the break recommendation point setting means 16 is explained. In drawing 28 (b), it is the same as that of drawing 28 (a) about a block distance, the section transit time, and a search path. About the path for which it was searched, the recommendation point of a break is determined out of a path using the break acquisition property (continuation transit time Trun) recorded on the transit property database 6. That is, about the first break point, when Trun time amount has passed since the origin, the point where a car exists is calculated using the block distance and transit characteristic value according to road attribute, and let this point be the 1st break recommendation point. Next, when Trun time amount passes further from this point with the 1st break recommendation point as the starting point, the point where a car exists is calculated, and let this point be the 2nd break recommendation point. And it asks for the break recommendation point similarly, and a break recommendation point is repeatedly set up until all paths are included in this.
[0115] Drawing 29 makes the break recommendation point set up with the break recommendation point setting means 14 contrast with the road network used for calculation, it is shown, and R mark in drawing shows a break recommendation point. Drawing 30 is an example of a display of the break recommendation point in the display means 10, and the display of the search path to the destination where the current position of a car and 53 were calculated for 52, and 55 are the break recommendation points called for in the break recommendation point setting means in drawing.
[0116] Since acquisition of a break is not made to reflect only in a duration, but a break recommendation point is calculated in the navigation equipment of the gestalt of this operation combining a search path and a transit property and it is made to display on a map, by the ability being able to recognize the location of a suitable break, it becomes possible to tell an operator more visually the timing which should take a break, and it becomes possible to contribute to the safety of transit.
[0117] Moreover, in the gestalt of this operation, you may constitute so that the distance of gestalt 4 publication of operation may be calculated as a gestalt of the break property study means 13 and the transit property database 6 and a break recommendation point may be calculated as criteria of a property.
[0118] Drawing 31 is a conceptual diagram about the calculation approach of the break recommendation point at the time of making distance into the criteria of a property. In drawing 31 , it is the same as that of drawing 28 (b) about a block distance, the section transit time, and a search path. About the path for which it was searched, the recommendation point of a break is determined out of a path using the break acquisition property (continuation mileage Lrun) recorded on the transit property database 6. That is, let the point which only the distance of Lrun separated from the origin be the 1st break recommendation point about the first break point. Next, let the point where only the distance of Lrun separated from this point further with the 1st break recommendation point as the starting point be the 2nd break recommendation point. And it asks for the break recommendation point similarly, and a break recommendation point is repeatedly set up until all paths are included in this.
[0119] When drawing 28 (b) explained, and computing a point, point count was performed, having computed distance by having used the continuation transit time Trun and a transit characteristic value, and taking into consideration size relation with the block distance of a search path, but when distance is made into the criteria of a property, point count is attained from an origin by dividing the section with the sequential continuation mileage Lrun. Thus, by making distance into the criteria of a property, in order to use not the continuation transit time but the continuation mileage Lrun, point count becomes easy, and count of a break recommendation point also generates the advantage whose computer load of break recommendation point calculation decreases.

[0120] Gestalt 8. drawing 32 of operation is drawing showing the configuration of the whole navigation equipment of the gestalt 8 of operation of this invention. In drawing, 15 is a circumference facility retrieval means to search the facility which can rest near the break recommendation point from the information on the various facilities recorded on the map database 3, and the positional information of the break recommendation point set up with the break recommendation point setting means 14, and to output facility information to the display means 10. Since others are the same as that of the gestalt 7 of operation, explanation is omitted.
[0121] Drawing 33 is drawing showing the display of the facility near [which was searched with the break recommendation point R55 and the circumference facility retrieval means 15 which are displayed with the display means 10 in the gestalt 8 of this operation] the point R which can be rested. Drawing 34 is the conceptual diagram of retrieval of the facility near [which was shown by drawing 33] the point R which can be near rested. In drawing 34 , R points are break recommendation points set up with the break recommendation point setting means 14, and ** mark and <> mark of the circumference of it are the positional information and the facility name of a circumference facility which are memorized by the map database. The circumference facility retrieval means 15 judges whether it is below the predetermined value as which the distance of the break recommendation point R and a surrounding facility was determined beforehand, and it outputs the positional information and facility classification to the display means 10 noting that it is the facility near the break recommendation point which can be rested, if it is below a predetermined value.
[0122] In the example shown in drawing 34 , since Restaurants A and D and tea drinking B exist below in a predetermined value (inside of a predetermined radius), as shown in drawing 33 , these locations and facility classification are displayed by the display means 10. As shown in drawing 33 , the display means 10 displays the location of the facility 56 which can be circumference rested while displaying the self-vehicle location 52, a search path 53, and the break recommendation point 54 on a map like the gestalt of old operation in response to the output of the circumference facility retrieval means 15.
[0123] It becomes possible to tell an operator visually the break location which can actually take a break since the facility which exists near the break recommendation point and which can be rested is searched from a map database in the navigation equipment of the gestalt of this operation and it displays on a map, and a break can be acquired without getting lost also in unfamiliar land, and it becomes that contributing to the safety of transit is possible.
[0124] Gestalt 9. drawing 35 of operation is drawing showing the configuration of the whole navigation equipment of the gestalt 9 of operation of this invention. In drawing, 7 is a user interface means to output the contents of selection of the operator about the selection of a facility information list and a break point setup which were shown in the display means 10 to the path planning means 8. 15 is a circumference facility retrieval means searches the facility which can rest near the break recommendation point from the information on the various facilities recorded on the map database 3, and the positional information of the break recommendation point set up with the break recommendation point setting means 14, and output a **** screen for a facility information list and a break point setup to the display means 10. Since others are the same as that of the gestalt 8 of operation, explanation is omitted.

[0125] Actuation of the gestalt of this operation is explained. With the gestalt of this operation, when searching for an induction path, an induction path is searched for, taking a break recommendation point into consideration. Since it is the same as that of the gestalt 8 of operation except the retrieval approach of an induction path, other explanation is omitted.
[0126] First, in the path planning means 8, while inputting the information in connection with a setup of the break point chosen with the user interface means 7, in case the point information about the facility which was searched with the circumference retrieval means 15 and which can be rested is inputted and retrieval between predetermined points is performed, it searches for an optimal path by using as the course ground said selected facility which can be rested.
[0127] Drawing 36 is an example of a display of break recommendation point selection of the display means 10 in the gestalt 9 of operation. The circumference retrieval means 15 searches the facility near the break recommendation point which can be rested like actuation of the gestalt 8 of said operation, and creates the list of the facility which can rest for every break recommendation point. The display means 10 displays by creating ****** which stimulates selection of whether to set the facility which can be rested as the course ground, the display of the facility from a list, presenting of the facility information on the facility chosen and chosen, activation of a setup, etc. according to the facility list created with the circumference retrieval means 15. The user interface means 7 is expressed as the display means 10, or inputs the contents of actuation of operators, such as a strike and the contents of a setting, and carries out the sequential output of the existence of a course ground setup, and the positional information of the set-up rest area at the path planning means 8.
[0128] The path planning means 8 inputs positional information from the circumference facility retrieval means 15 about all the facilities that were set up when the usual retrieval was carried out and the facility which can be rested was set as the course ground, if it judged whether a course ground setup was directed and the facility which can be

rested was not set as the course ground by the user interface means 7 and that can be rested. Furthermore, the path planning means 8 carries out the path planning between predetermined points so that the location of these circumference facilities may be included in a path. The optimal path for which it was searched is displayed with a map by the display means 10 like the gestalt of said operation, and performs induction to an operator.
[0129] Drawing 37 is an example of the display in the gestalt 9 of this operation, and when one in the candidate of the break recommendation facility of the gestalt 8 of operation (<> tea drinking B) is selected, it is shown that the retrieval result 53 which this selection facility includes is displayed. Moreover, although explanation of the gestalt of this operation explained only the case of an ordinary road using drawing, you may constitute from a driveway of a highway etc. so that priority may be given to the service area and parking area on a route and it may consider as the facility which can be rested.
[0130] In the navigation equipment of the gestalt of this operation It calculates a break recommendation point combining a search path and a transit property rather than reflecting acquisition of a break only in business time amount. Since it is constituted so that it may be contained in the search path which searches the facility which furthermore exists near this break recommendation point, and which can be rested from a map database, and connects a predetermined point, and it may search for a path Since it is exactly guided to a break point, without being able to compute a near duration by the actual duration and getting lost also in unfamiliar land even if it can acquire a break and does not see a map when actually acquiring a break and carrying out real transit, It becomes possible to contribute to improvement in convenience and the safety of transit.
[0131] Moreover, in the gestalten 5-9 of operation, although the average transit duration and the average recess which are not every road attribute are found as shown in drawing 24 R> 4, it may be considered the transit property explained in the gestalten 1-4 of operation the same way, and average transit duration and an average recess may also be found for every road attribute.
[0132]
[Effect of the Invention] The business time amount taken for the navigation equipment concerning this invention to run the path which a car becomes from a road segment is computed from road information by segment and the transit information about the road segment classified for every road attribute. [the case where it runs the road link it has never run since it searches for the induction path which guides a car based on this duration, or when there are few counts of transit] It asks using the information acquired by real transit by the road of the same attribute in the duration of the road link, and the duration in consideration of each operator's taste can be found.
[0133] Since it is classified for every operator who operates a car, even when a different operator uses the same car, the duration prediction reflecting each operator's property of transit information is attained.
[0134] Since transit information is the velocity distribution of a car, it can be classified into two or more rate attributes to one road link, and can search for each operator's transit property using various technique.
[0135] Since transit information is a velocity distribution over distance, the travel speed of the car in the case of computing a duration serves as weighting equal from a low speed to a high speed, and it can find an exact duration.
[0136] Since it has a car situation measurement means measure the movement condition of a car, and a transit property study means correct the transit information on a car based on the movement condition measured in the car situation measurement means, when a car runs, transit information can correct, it becomes computable [the duration reflecting each operator's transit taste], and it becomes that it is possible in improving the precision of duration prediction.
[0137] Since it searches for the induction path which guides a car from a road segment and break acquisition information, it can contribute also to the safety of transit by improving the precision of a duration and taking a proper break into consideration.
[0138] Since break acquisition information is searched for according to transit of a car, it can find the exact duration according to an operator's taste, and can raise the precision of a duration more.
[0139] Since the vacation acquisition point which searched the break acquisition point and was searched in the path planning means in the display means in the path planning means from a road segment and break acquisition information is displayed, an operator can recognize a break acquisition point, and it becomes possible to tell an operator more visually the timing which should take a break, and becomes that contributing to the safety of transit is possible.
[0140] Since the vacation possible facility which searched the facility near the break acquisition point which can be rested, and was searched in the path-planning means in the display means in the path-planning means from road information by segment and break acquisition information displays, an operator can recognize the location which can actually acquire a break, and he understands a break acquisition location, without wavering also in unfamiliar land, and it becomes that contributing to the safety of transit is possible.
[0141] Since the facility near the break acquisition point which can be rested is searched from a road segment and break acquisition information, and it searches for an induction path in a path planning means so that said facility which can be rested may be included in the induction path which guides a car from a road segment Since it is

exactly guided to a break point, without knowing an exact duration including an actual break and getting lost also in unfamiliar land even if it can acquire a break and does not see a map, it becomes possible to contribute to improvement in convenience and the safety of transit.

[0142] Since it has a car situation measurement means to measure the movement condition of a car, and a break acquisition property study means to correct the break acquisition information memorized by the break acquisition property database based on the movement condition measured in the car situation measurement means When a car runs, a break acquisition property can be corrected, it becomes computable [the duration reflecting each operator's transit taste], and it becomes possible to improve the precision of duration prediction.

[0143] A car situation measurement means can measure the movement condition of the car at the time of transit in the condition of not performing path planning and of not guiding, and the taste of the travel speed in the case of running in the state of no guiding, since a study means corrects information based on the movement condition measured in the state of no guiding can also be made to reflect.

[Translation done.]

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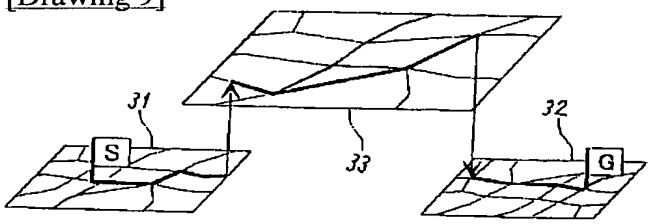
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

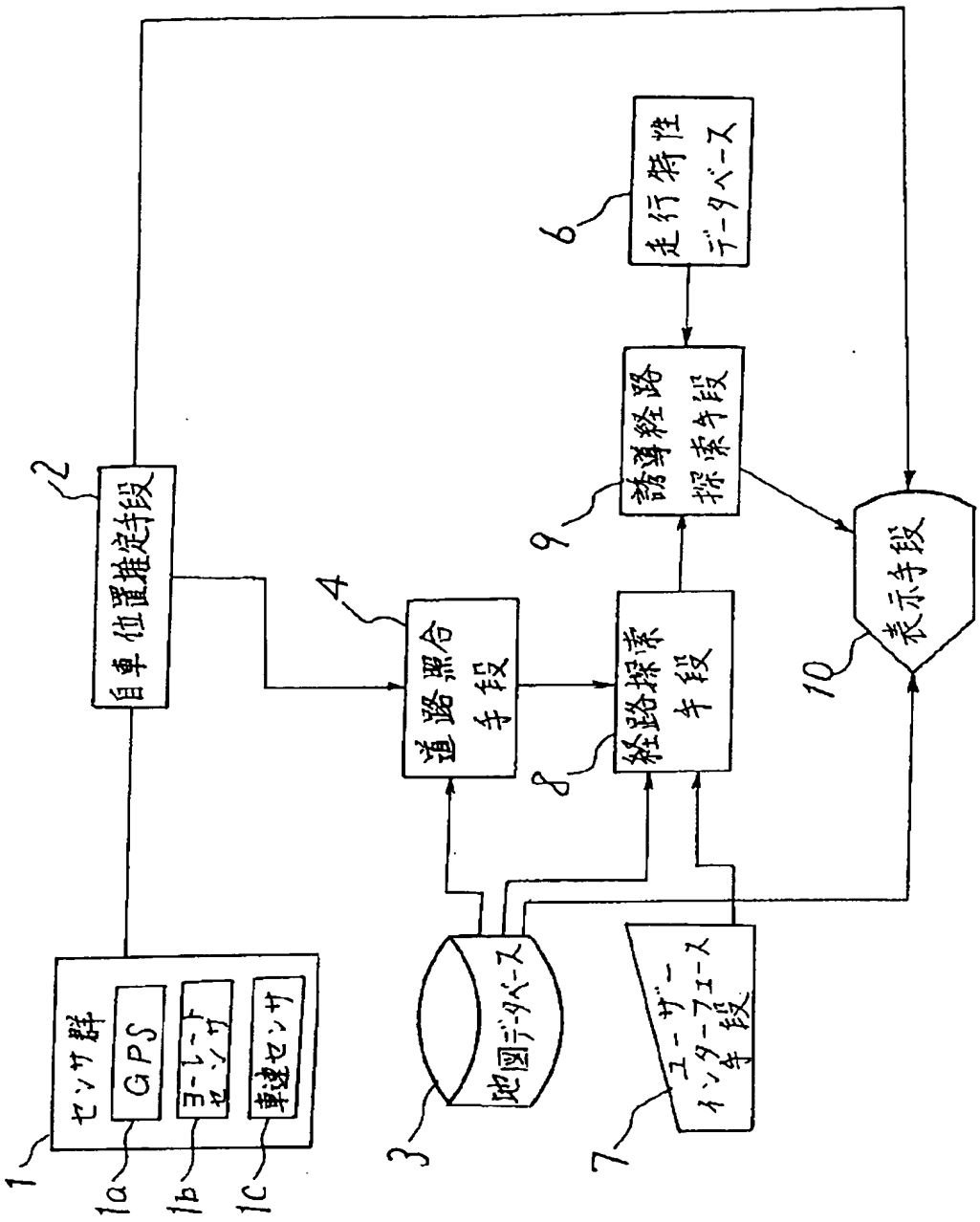
[Drawing 5]

道路属性	走行特性 (h/km)
高速自動車道	0.01053
自動車専用道	0.01251
主要国道	0.01538
一般国道	0.01818
主要地方道	0.01667
一般道	0.02564

[Drawing 9]

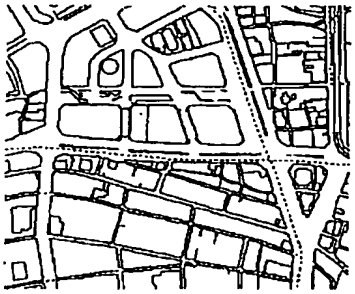


[Drawing 1]

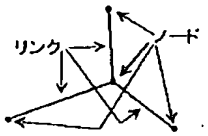

センサ群
GPS
ヨーレートセンサ
車速センサ
1
1a
1b
1c
自車位置推定手段
2
地図データベース
3
道路照合手段
4
経路探索手段
8
誘導経路探索手段
9
表示手段
10
走行特性データベース
6
ユーザーインターフェース手段
7

[Drawing 2]

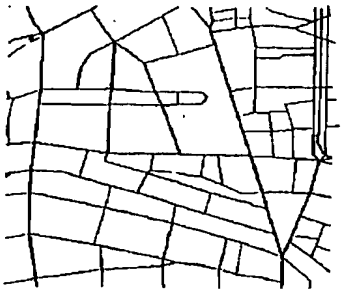
(a)



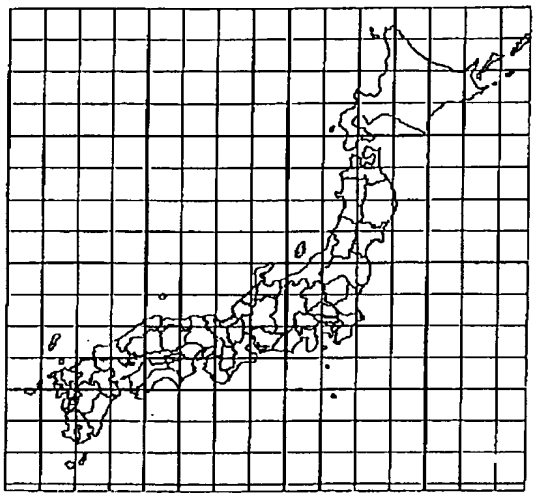
(b)



(c)

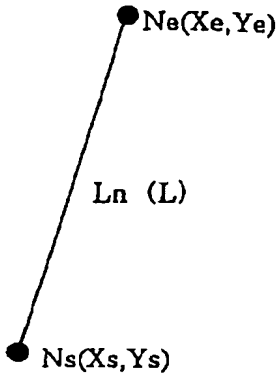


[Drawing 3]



[Drawing 4]

(a)



(b)

リンク番号	Ln
始点ノード番号	Ns
終点ノード番号	Ne
始点座標	Xs,Ys
終点座標	Xe,Ye
リンク長	L
始点接続リスト	Ns-1
	Ns+1
	…
終点接続リスト	Ne-1
	Ne+1
	…
道路属性リスト	
…	

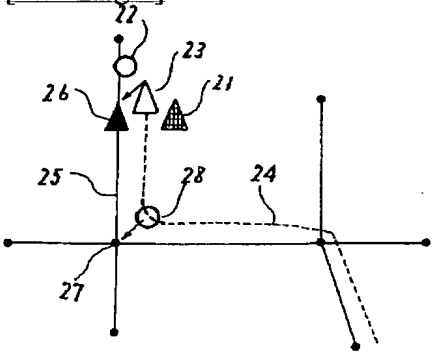
(c)

種別	一般国道
規制速度	40km/h
実勢速度	55km/h
道路幅員	10m
車線数	2
規制有無	あり
規制種別	一方通行
…	…

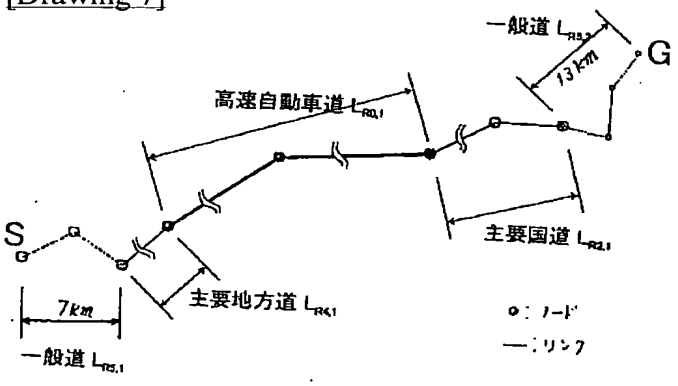
[Drawing 12]

高速自動車道	
走行距離(km)	積算時間 (分)
2500	1500

[Drawing 6]



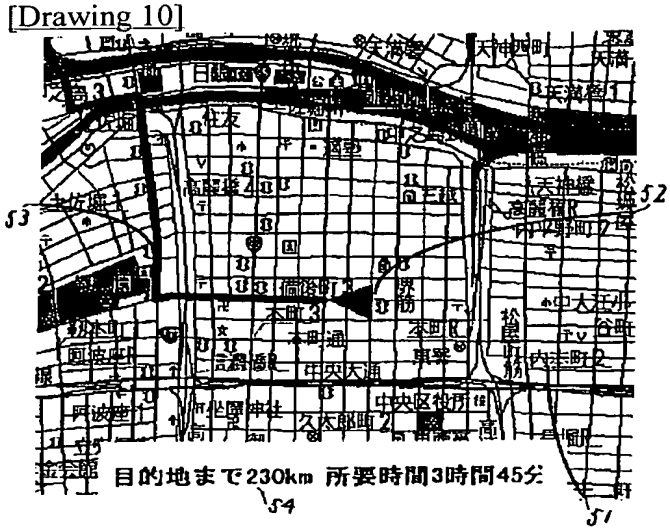
[Drawing 7]



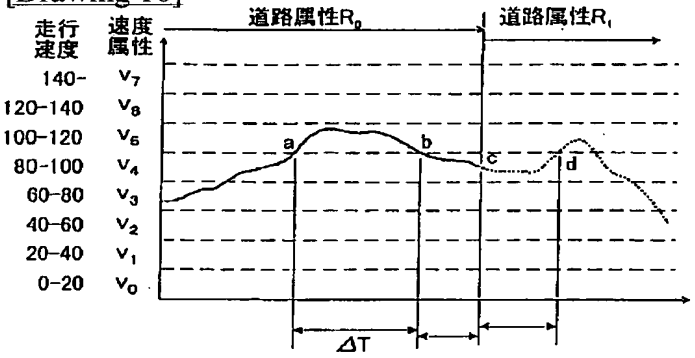
[Drawing 8]

道路属性	属性別距離 $\Sigma L_{(道路属性),k}$	走行特性 (h/km)	道路属性別所要時間
高速自動車道	$L_{R0,1}$ (120Km)	0.01053	1.26
自動車専用道	0	0.01250	0.00
主要国道	$L_{R2,1}$ (40Km)	0.01538	0.62
一般国道	0	0.01818	0.00
主要地方道	$L_{R4,1}$ (80Km)	0.01667	1.33
一般道	$L_{R5,1}+L_{R5,2}$ (20Km)	0.02564	0.51
全区間	260 Km	—	3時間43分

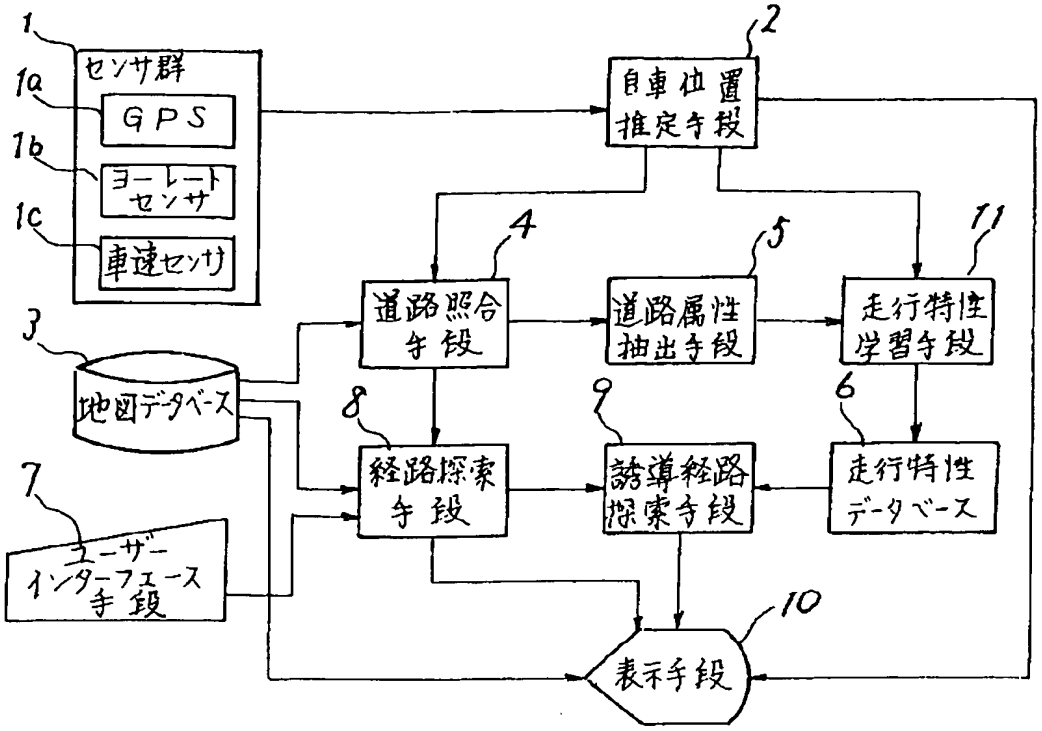
[Drawing 10]



[Drawing 16]



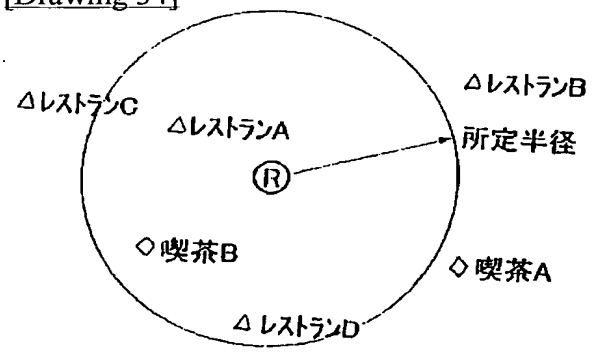
[Drawing 11]



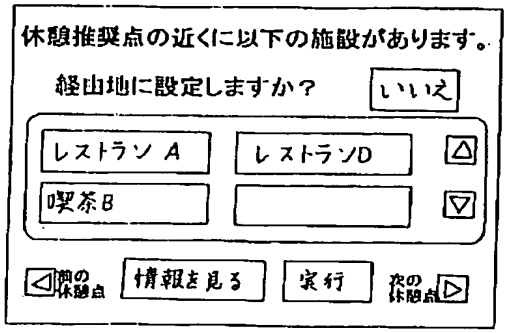
[Drawing 17]

道路属性	属性別距離 $\Sigma L_{(道路属性),k}$	走行特性 (km／h)	道路属性別所要時間
高速自動車道	$L_{R0,1}$ (120Km)	95	1. 26
自動車専用道	0	80	0. 00
主要国道	$L_{R2,1}$ (40Km)	65	0. 62
一般国道	0	55	0. 00
主要地方道	$L_{R4,1}$ (80Km)	60	1. 33
一般道	$L_{R5,1}+L_{R5,2}$ (20Km)	39	0. 51
全区間	260 Km	—	3時間43分

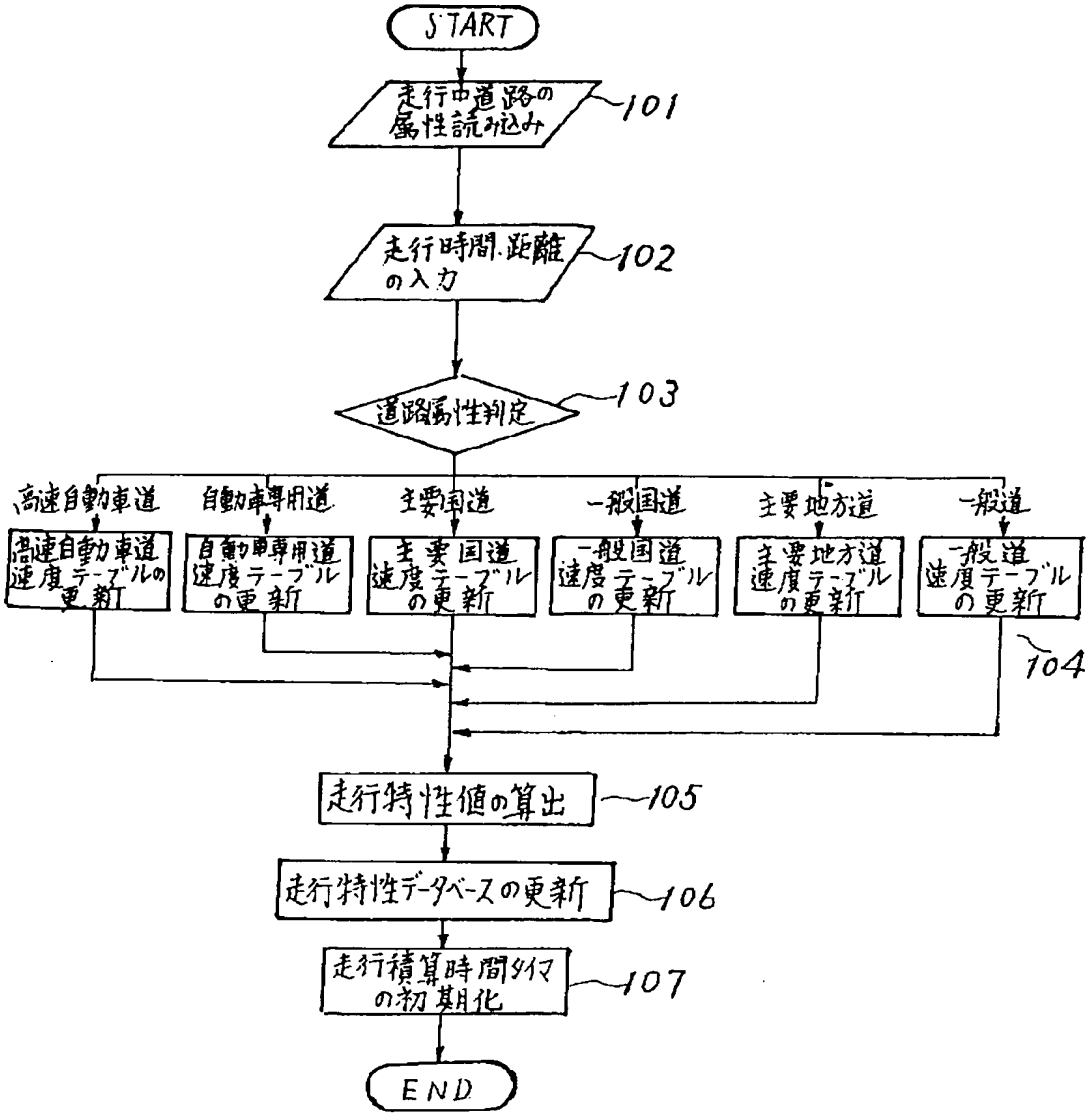
[Drawing 34]



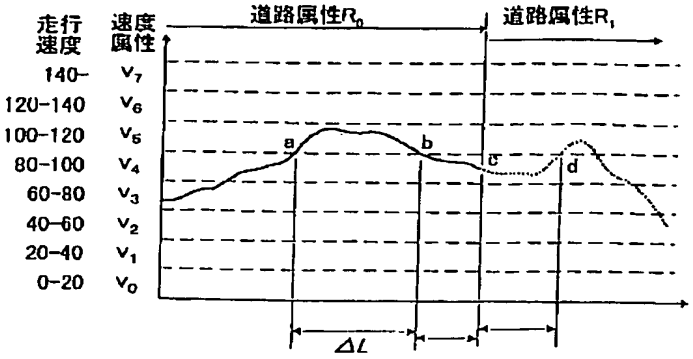
[Drawing 36]



[Drawing 13]



[Drawing 19]



[Drawing 14]

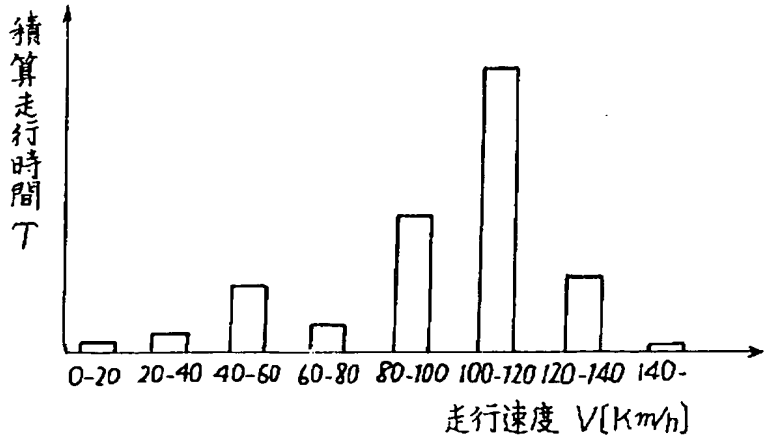
(a)

道路属性	走行特性(km／h)
高速自動車道	95
自動車専用道	80
主要国道	65
一般国道	55
主要地方道	60
一般道	39

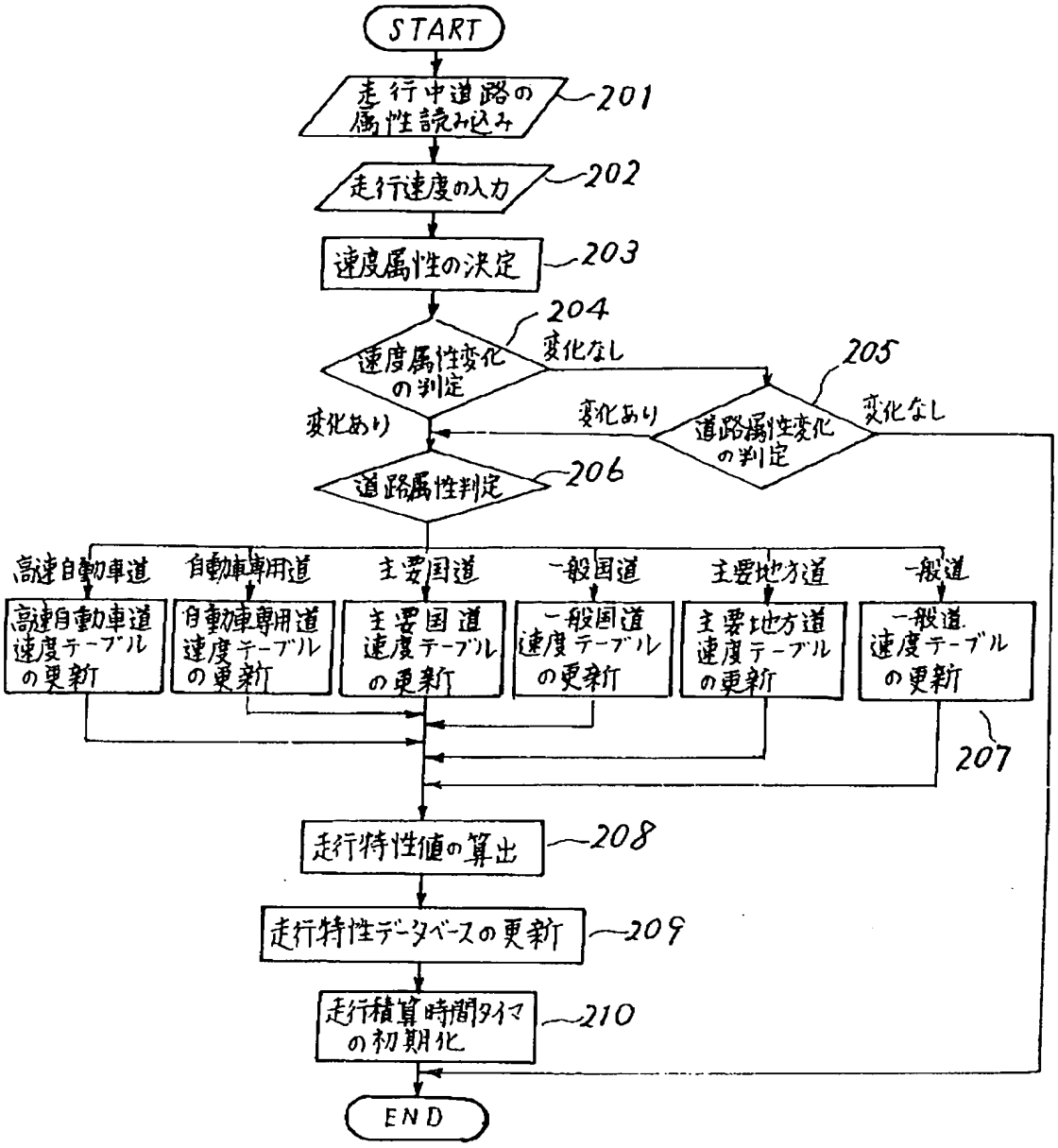
(b)

高速自動車道			
走行速度	速度属性	積算時間(分)	時間比率(%)
0-20	V_0	10	1.6
20-40	V_1	20	3.1
40-60	V_2	70	11.0
60-80	V_3	30	4.7
80-100	V_4	140	22.0
100-120	V_5	280	44.1
120-140	V_6	80	12.6
140－	V_7	5	0.8

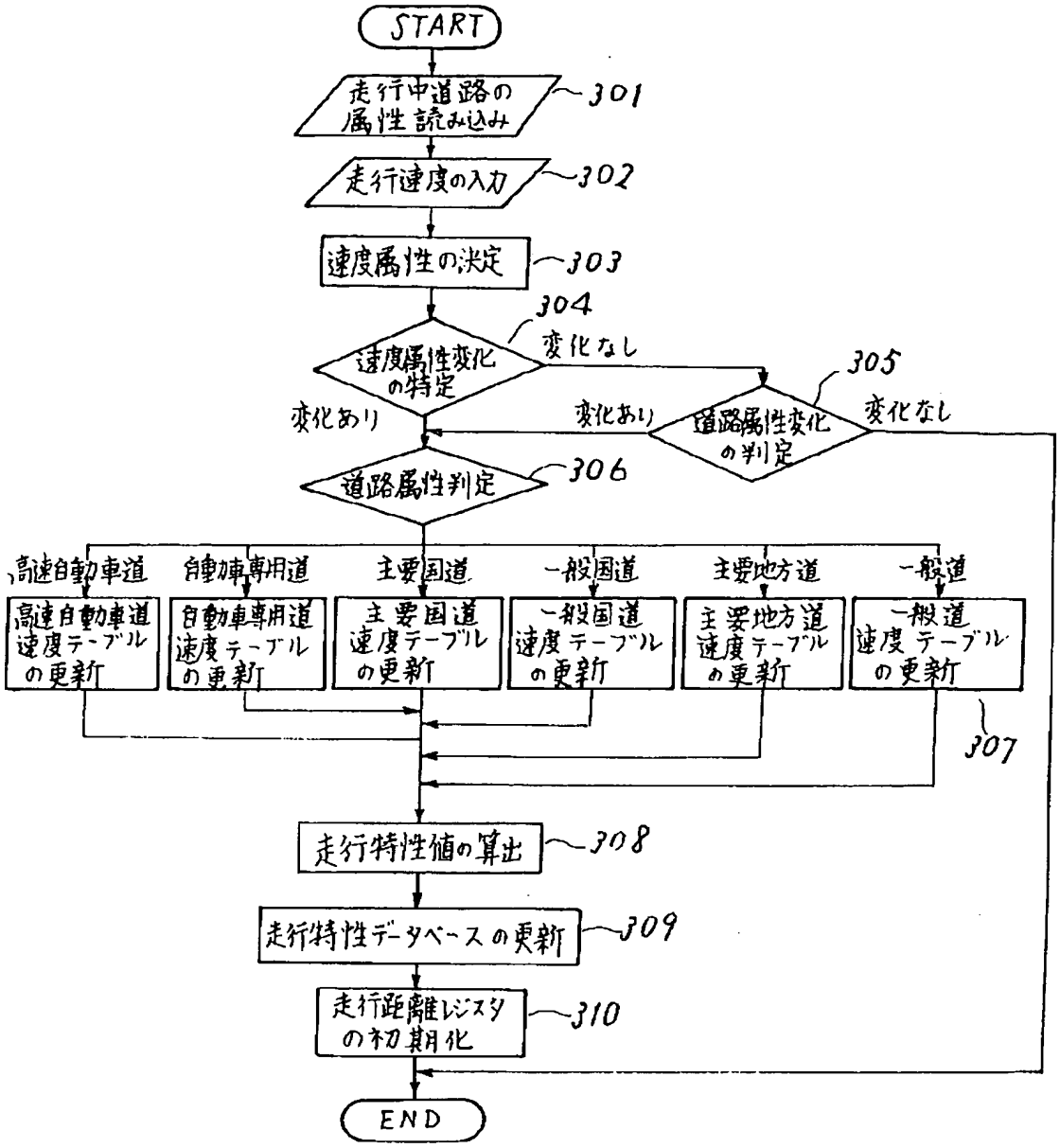
(c)



[Drawing 15]


START
走行中道路の属性読み込み
201
走行速度の入力
202
速度属性の決定
203
速度属性変化の判定
204
変化なし
変化あり
道路属性変化の判定
205
変化なし
変化あり
道路属性判定
206
高速自動車道
自動車専用道
主要国道
一般国道
主要地方道
一般道
高速自動車道速度テーブルの更新
自動車専用道速度テーブルの更新
主要国道速度テーブルの更新
一般国道速度テーブルの更新
主要地方道速度テーブルの更新
一般道速度テーブルの更新
207
走行特性値の算出
208
走行特性データベースの更新
209
走行積算時間タイマの初期化
210
END

[Drawing 18]

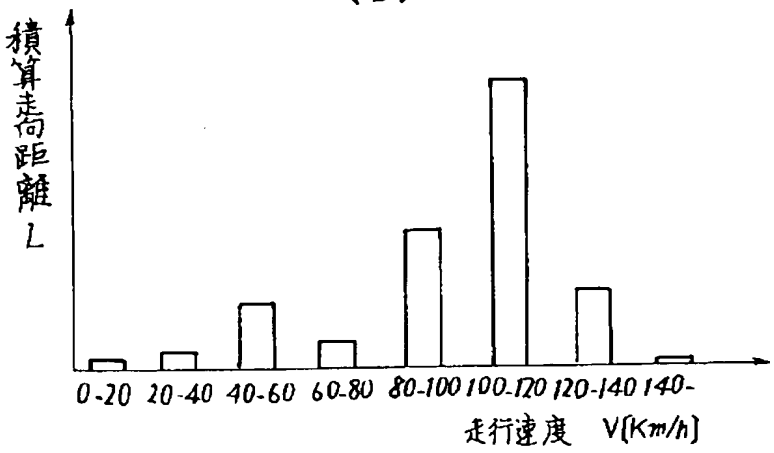

START
走行中道路の属性読み込み
301
走行速度の入力
302
速度属性の決定
303
304
速度属性変化の特定
変化なし
変化あり
305
道路属性変化の判定
変化あり
変化なし
道路属性判定
306
高速自動車道
自動車専用道
主要国道
一般国道
主要地方道
一般道
高速自動車道速度テーブルの更新
自動車専用道速度テーブルの更新
主要国道速度テーブルの更新
一般国道速度テーブルの更新
主要地方道速度テーブルの更新
一般道速度テーブルの更新
307
走行特性値の算出
308
走行特性データベースの更新
309
走行距離レジスタの初期化
310
END

[Drawing 20]

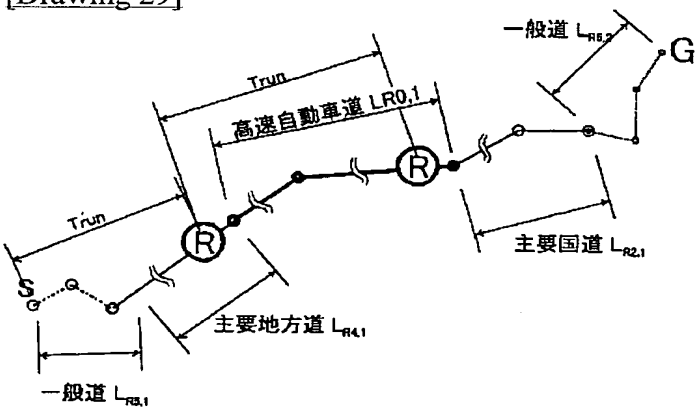
(a)

高速自動車道			
走行速度	速度属性	積算距離 (Km)	距離比率 (%)
0-20	V_0	10	1.6
20-40	V_1	20	3.1
40-60	V_2	70	11.0
60-80	V_3	30	4.7
80-100	V_4	140	22.0
100-120	V_5	280	44.1
120-140	V_6	80	12.6
140−	V_7	5	0.8

(b)



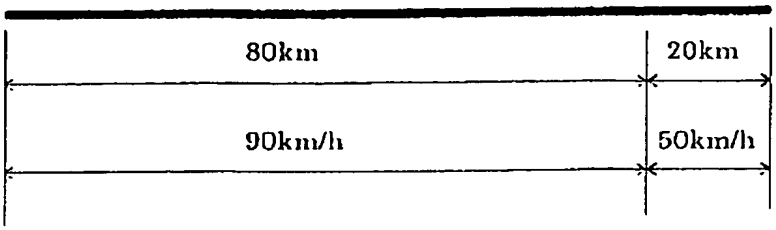
[Drawing 29]



[Drawing 21]

(a)

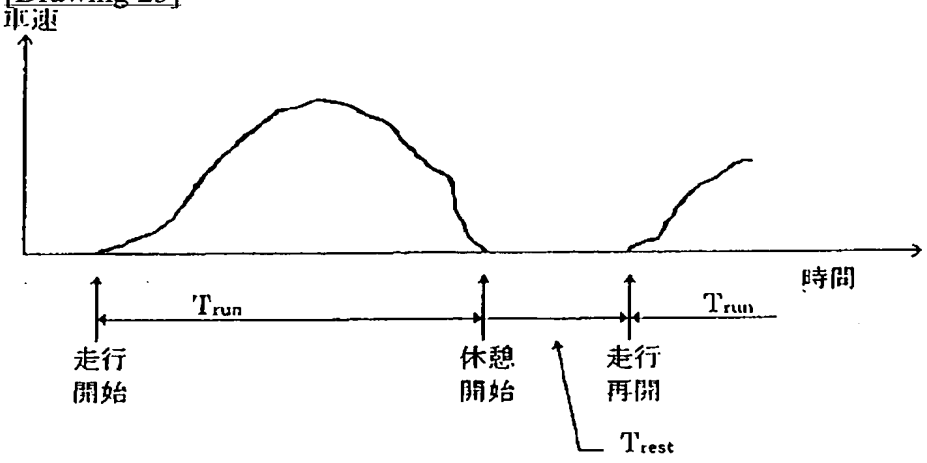
高速自動車道　属性　１００ｋｍ区間



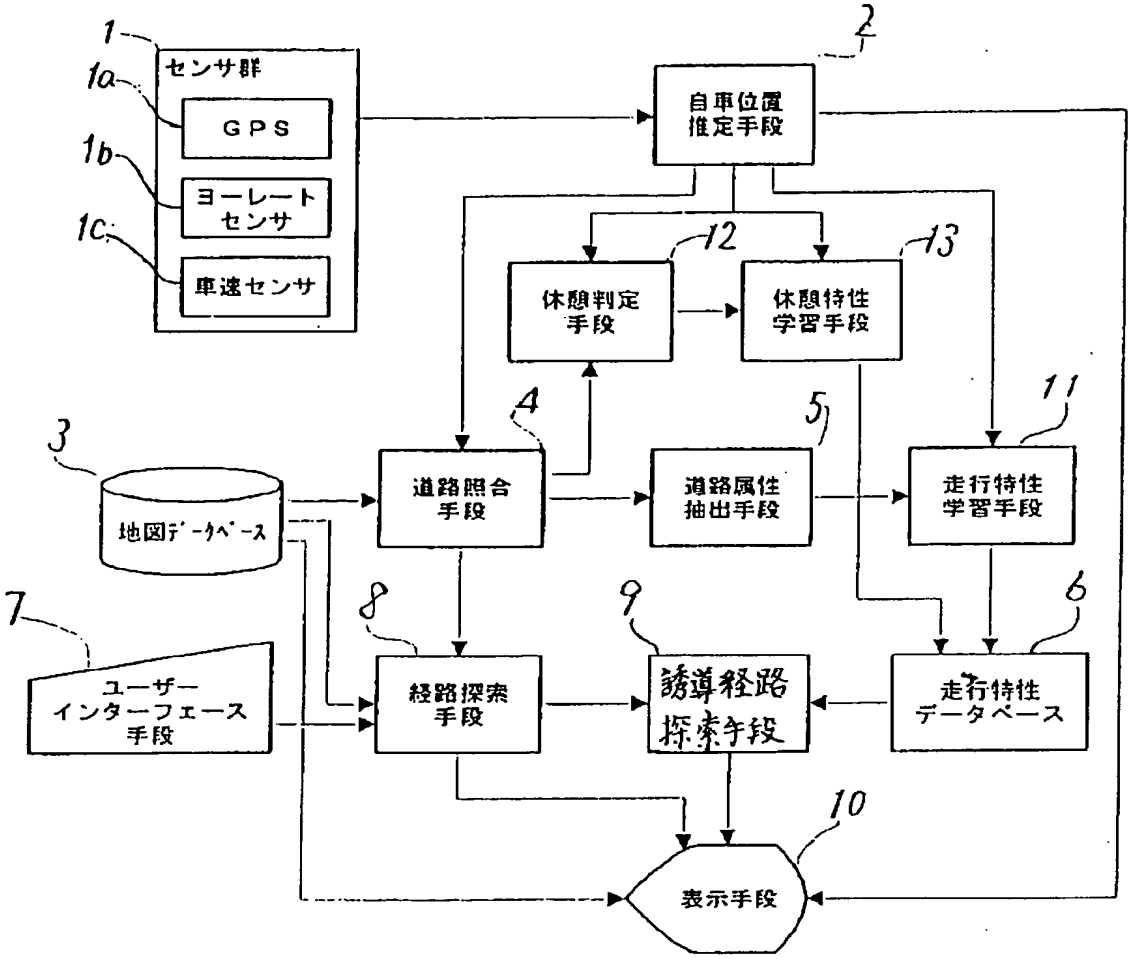
(b)

走行速度	速度属性	時間ベース 積算時間 (h)	時間ベース 時間比率 (%)	距離ベース 積算距離 (km)	距離ベース 距離比率 (%)
0-20	V_0	0	0	0	0
20-40	V_1	0	0	0	0
40-60	V_2	0.4	31	20	20
60-80	V_3	0	0	0	0
80-100	V_4	0.89	69	80	80
100-120	V_5	0	0	0	0
120-140	V_6	0	0	0	0
140−	V_7	0	0	0	0
Total		1.29		100	

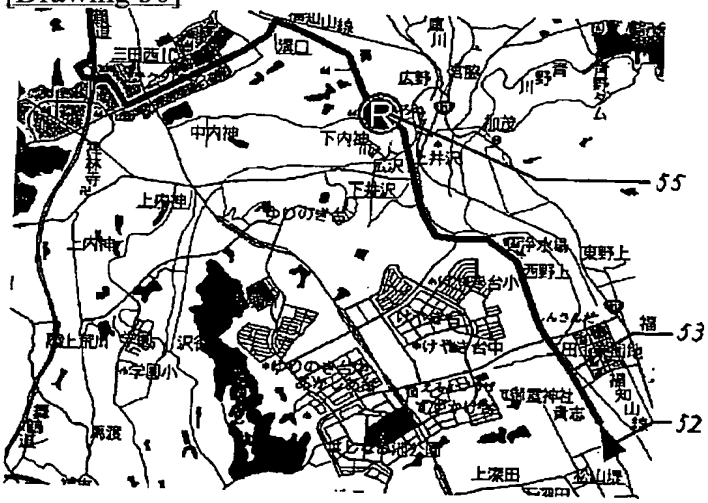
[Drawing 23]



[Drawing 22]



[Drawing 30]



[Drawing 24]

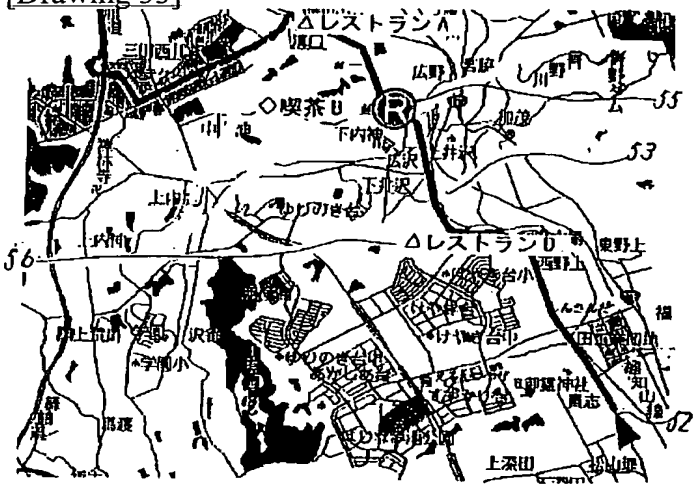
(a)

道路属性	走行特性(km／h)
高速自動車道	95
自動車専用道	80
主要国道	65
一般国道	55
主要地方道	60
一般道	39
平均走行継続時間	1時間20分
平均休憩時間	15分

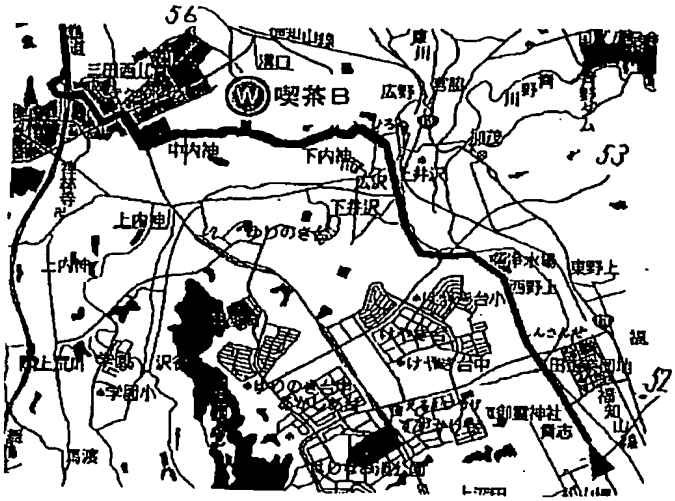
(b)

道路属性	属性別距離 $\Sigma L_{(道路属性),k}$	走行特性 (km／h)	道路属性別 所要時間
高速自動車道	$L_{R0,1}$ (120Km)	95	1.26
自動車専用道	0	80	0.00
主要国道	$L_{R2,1}$ (40Km)	65	0.62
一般国道	0	55	0.00
主要地方道	$L_{R4,1}$ (80Km)	60	1.33
一般道	$L_{R5,1}+L_{R5,2}$ (20Km)	39	0.51
全区間	260 Km	—	3時間43分
推奨パターン			
	走行時間	休憩時間	所要時間
第1区間	1時間20分	15分	1時間35分
第2区間	1時間20分	15分	3時間10分
第3区間	1時間03分		4時間13分
全区間	3時間43分	30分	4時間13分

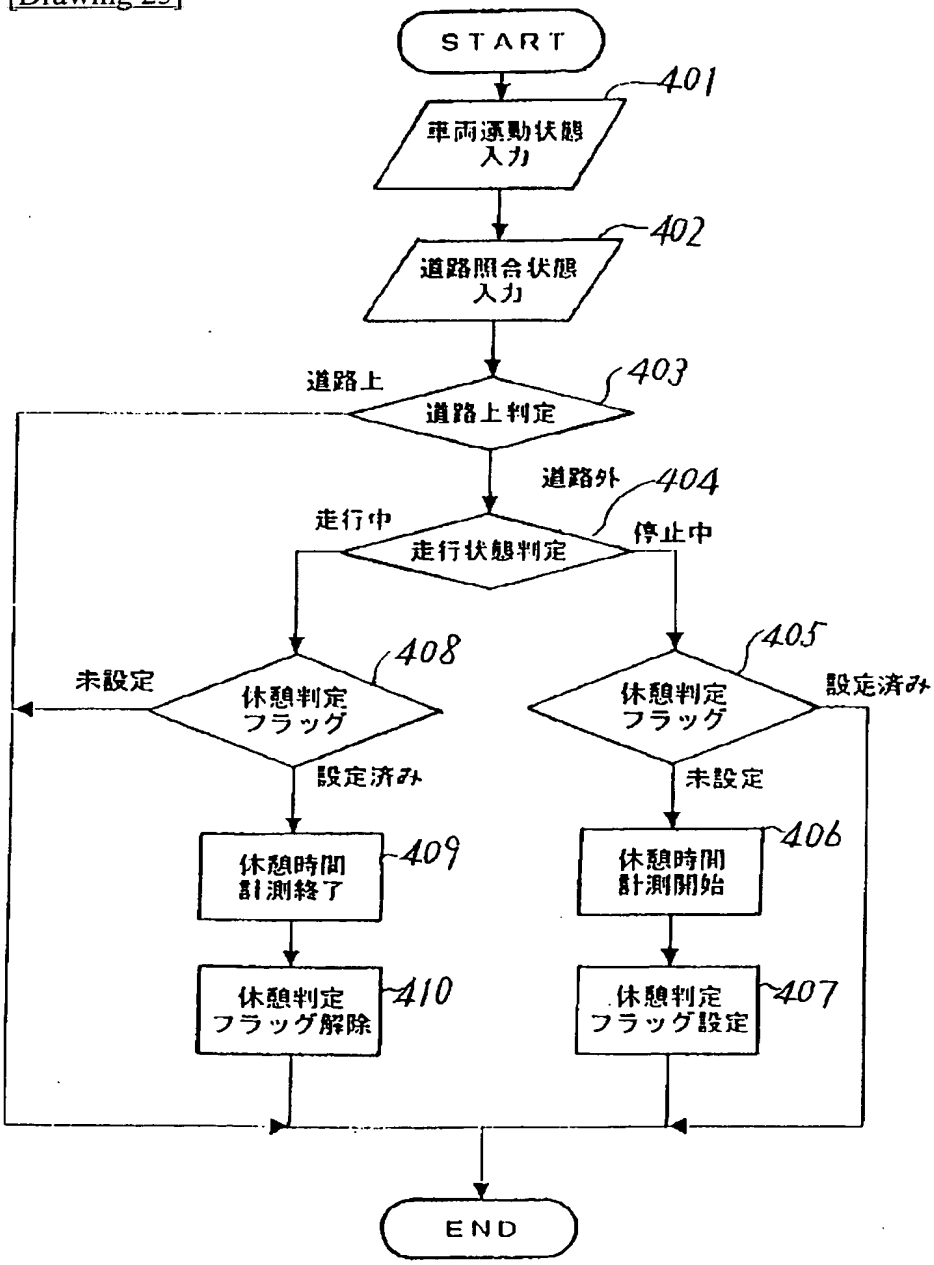
[Drawing 33]



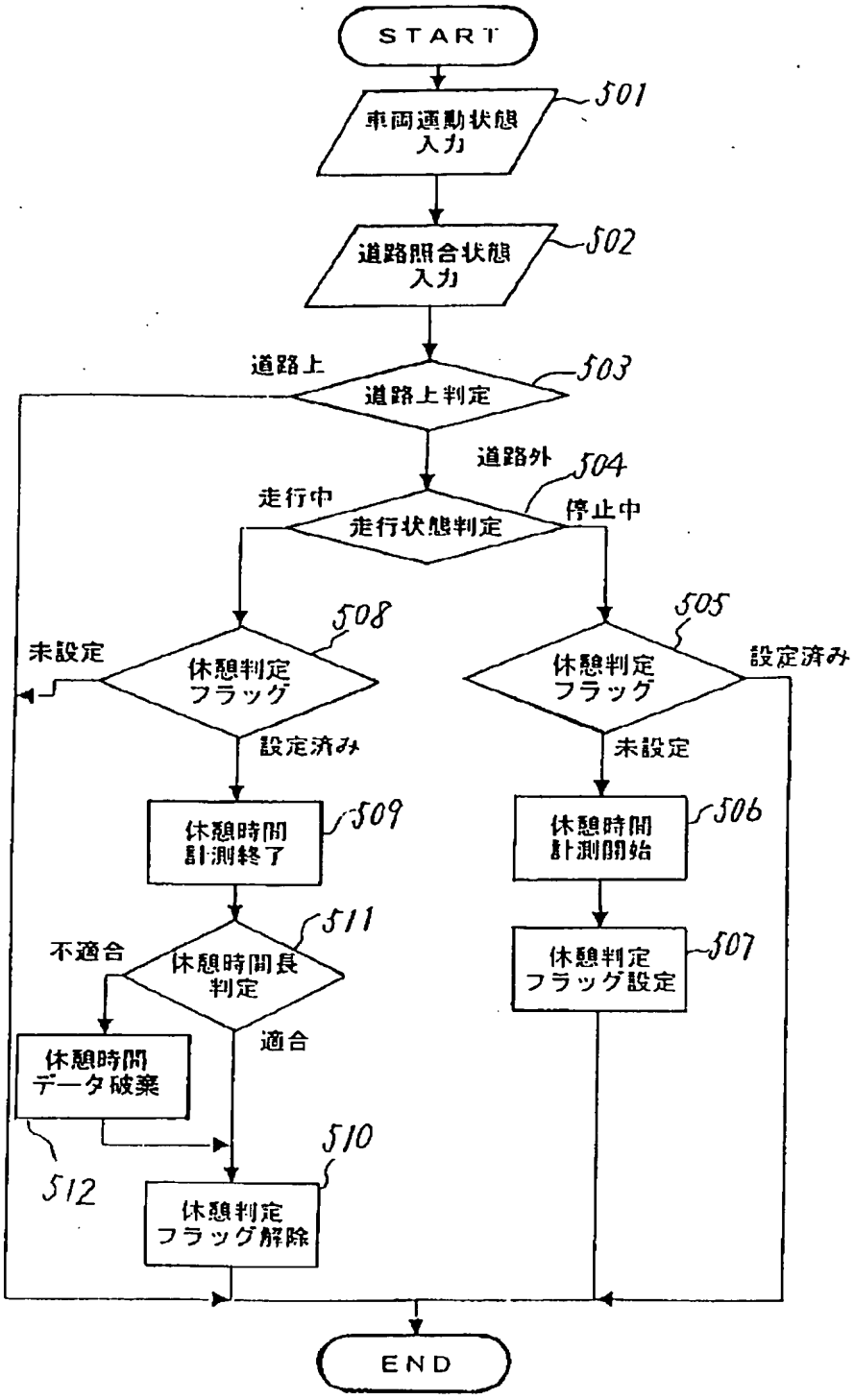
[Drawing 37]



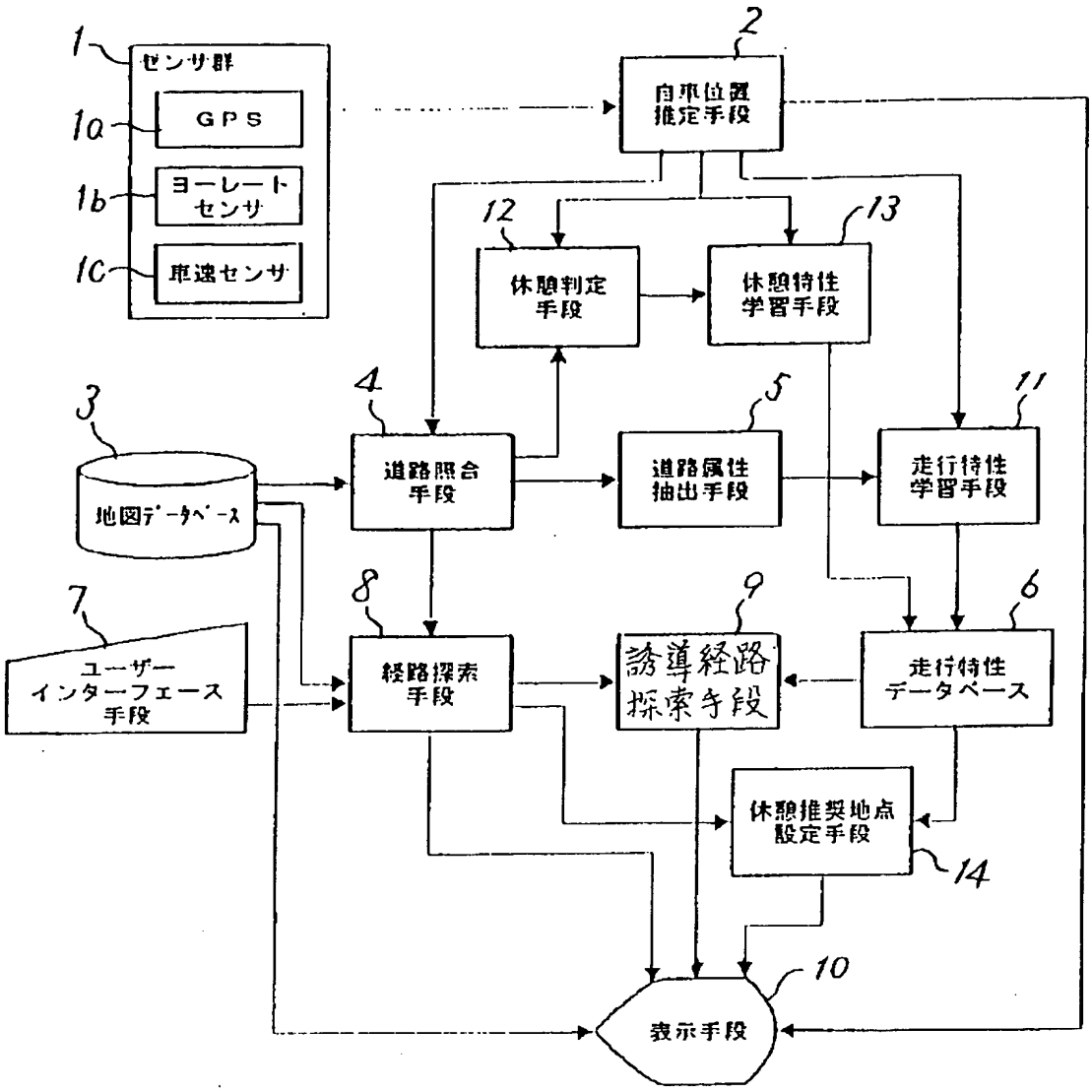
[Drawing 25]



[Drawing 26]


START
車両運動状態入力
501
道路照合状態入力
502
道路上
道路上判定
503
道路外
走行中
走行状態判定
504
停止中
未設定
休憩判定フラッグ
508
設定済み
休憩判定フラッグ
505
設定済み
未設定
休憩時間計測終了
509
休憩時間計測開始
506
不適合
休憩時間長判定
511
適合
休憩判定フラッグ設定
507
休憩時間データ破棄
512
休憩判定フラッグ解除
510
END

[Drawing 27]

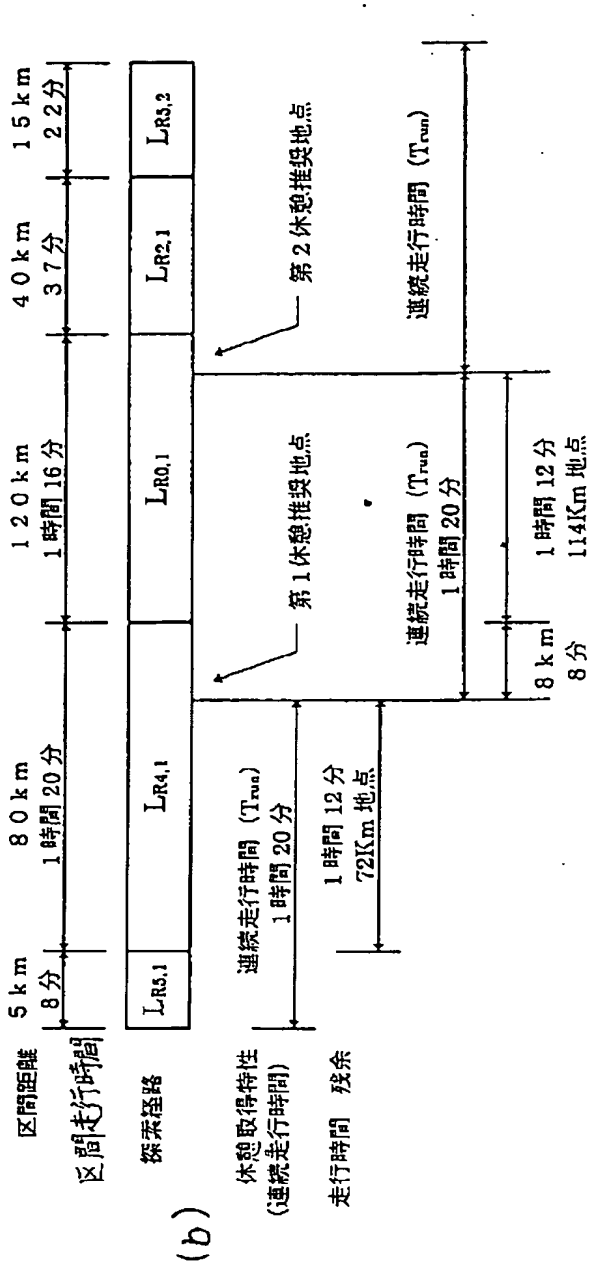

1
センサ群
1a
GPS
1b
ヨーレートセンサ
1c
車速センサ
2
自車位置推定手段
12
休憩判定手段
13
休憩特性学習手段
3
地図データベース
4
道路照合手段
5
道路属性抽出手段
11
走行特性学習手段
7
ユーザーインターフェース手段
8
経路探索手段
9
誘導経路探索手段
6
走行特性データベース
休憩推奨地点設定手段
14
10
表示手段

[Drawing 28]

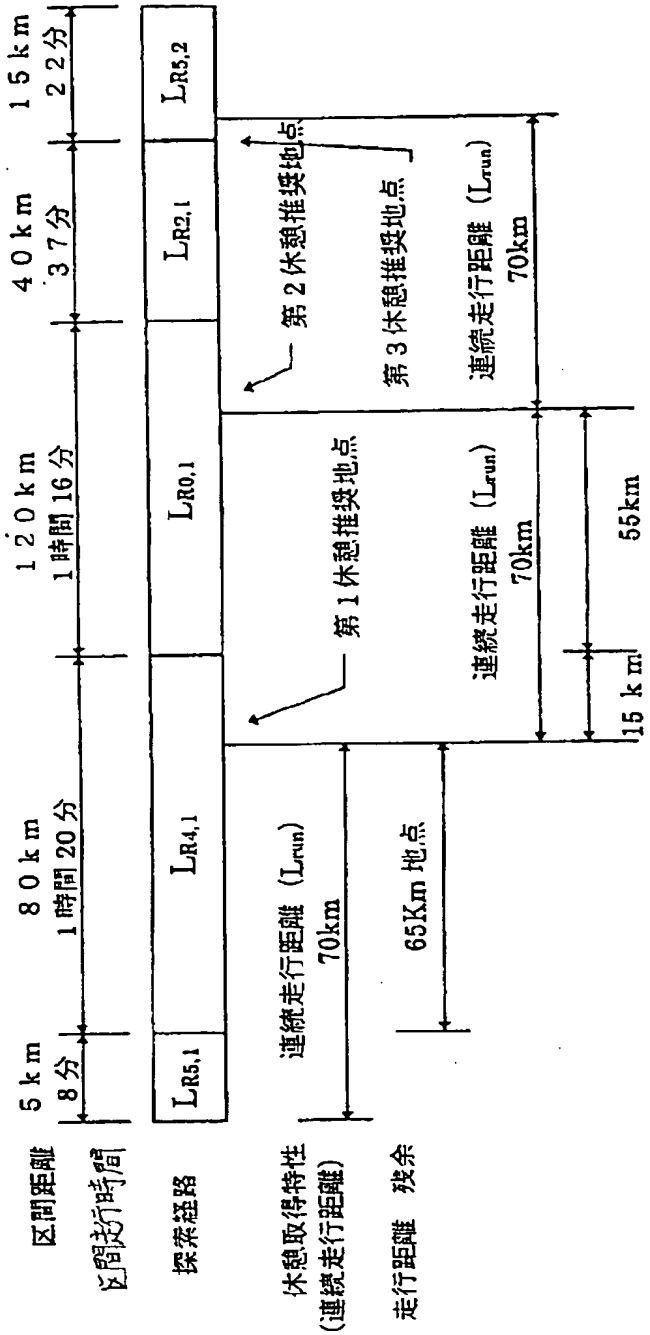
(a)

区間番号	$L_{R5,1}$	$L_{R4,1}$	$L_{R0,1}$	$L_{R2,1}$	$L_{R5,2}$	
道路属性	一般道	主要地方道	高速自動車道	主要国道	一般道	
区間距離(km)	5	80	120	40	15	260
走行特性(km/h)	39	60	95	65	39	—
区間走行時間	8分	1時間20分	1時間16分	37分	22分	
累積走行時間	8分	1時間28分	2時間44分	3時間21分	3時間43分	3時間43分

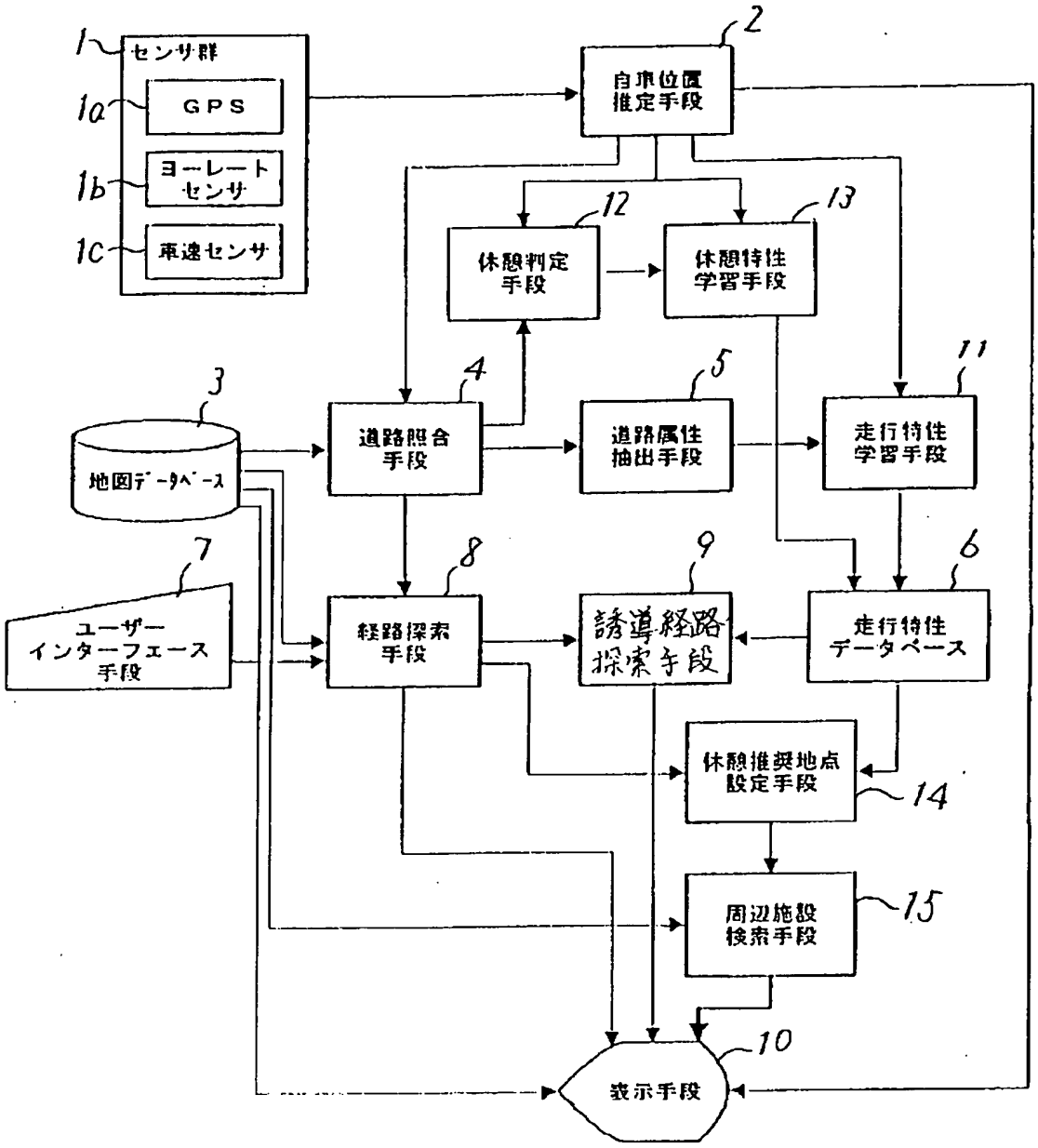
(b)



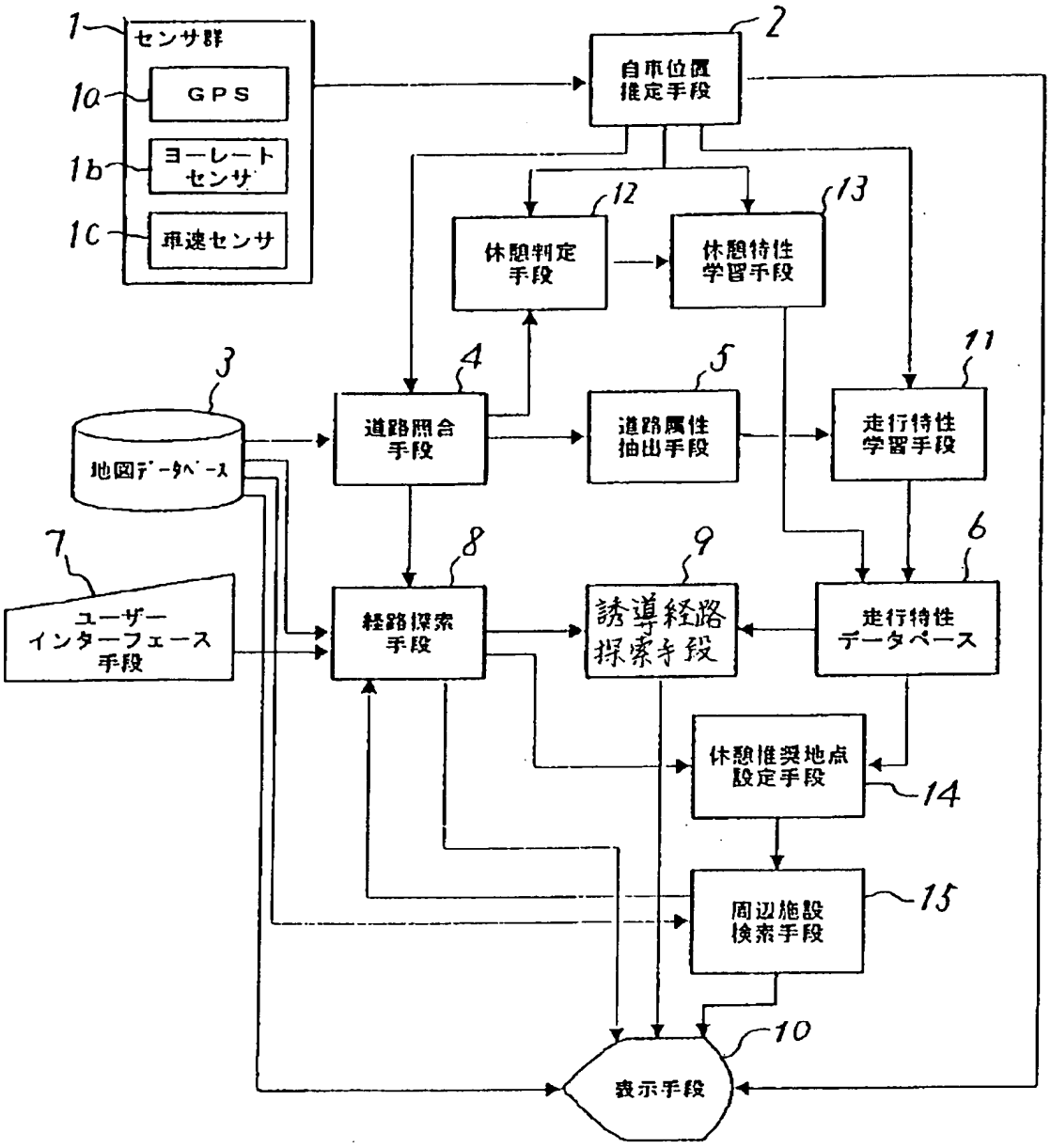
[Drawing 31]


区間距離
区間走行時間
探索経路
休憩取得特性
(連続走行距離)
走行距離 残余
5 km
8分
80 km
1時間 20分
120 km
1時間 16分
40 km
37分
15 km
22分
LR5,1
LR4,1
LR0,1
LR2,1
LR5,2
連続走行距離 (Lrun)
70km
65Km 地点
第1休憩推奨地点
第2休憩推奨地点
第3休憩推奨地点
連続走行距離 (Lrun)
70km
55km
15 km

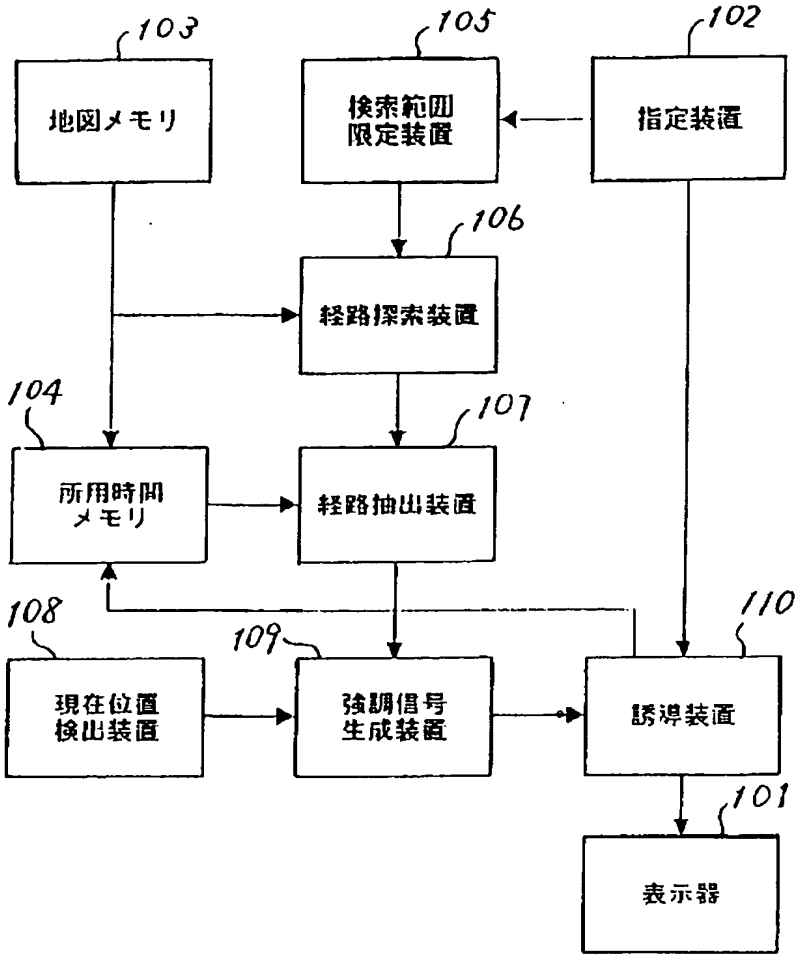
[Drawing 32]


1
センサ群
1a
GPS
1b
ヨーレートセンサ
1c
車速センサ
2
自車位置推定手段
12
休憩判定手段
13
休憩特性学習手段
3
地図データベース
4
道路照合手段
5
道路属性抽出手段
11
走行特性学習手段
7
ユーザーインターフェース手段
8
経路探索手段
9
誘導経路探索手段
6
走行特性データベース
休憩推奨地点設定手段
14
周辺施設検索手段
15
10
表示手段

[Drawing 35]


1
センサ群
1a
GPS
1b
ヨーレートセンサ
1c
車速センサ
2
自車位置推定手段
12
休憩判定手段
13
休憩特性学習手段
3
地図データベース
4
道路照合手段
5
道路属性抽出手段
11
走行特性学習手段
7
ユーザーインターフェース手段
8
経路探索手段
9
誘導経路探索手段
6
走行特性データベース
休憩推奨地点設定手段
14
周辺施設検索手段
15
10
表示手段

[Drawing 38]



[Translation done.]